Apparatus for printing digital image data
Vorrichtung zum Drucken von digitalen Bilddaten
Appareil pour imprimer des donnees numeriques d'image

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Patent

Country Code/Number	Kind	Date
EP 689157	A2	December 27, 1995 (Basic)
EP 689157	A3	May 15, 1996
EP 689157	B1	August 16, 2001

Application

Country Code/Number	Date
EP 94203730	December 22, 1994

Priority Application Number (Country Code, Number, Date): NL 94918 (940607)
Designated States: DE; FR; GB; IT; NL; SE
International Patent Class: G06K-015/00
Cited Patents (EP B): WO 89/06024 A; DE 3621543 A; GB 2248129 A

Cited References (EP B):

- PATENT ABSTRACTS OF JAPAN vol. 17, no. 150 (E-1339) 25 March 1993 & JP-A-04 317 251 (CANON INC) 9 November 1992
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Abstract: EP 689157 A2

A printer for digital image information, wherein supplied data files containing image data for printing, are stored in a memory and are not printed until an operator has given a print command by means of a key on the control panel. The data files in the memory are listed on a display in the control panel for an operator to select one for printing before he gives the print command. Also, before giving this command, the operator can optionally adjust the printer settings in order thus to obtain a print of the required appearance. The printer can also be provided with a scanner for scanning documents and then act as a copying machine. In that case, printing and copying become essentially similar functions with identical operation. (see image in original document)

Note:
Figure number on first page: 1

Legal Status

Type	Pub Date	Kind	Description
Grant:	010816	B1	Granted patent
Application:	951227	A2	Published application (A1 with Search Report;A2 without Search Report)
Oppn None:	020807	B1	No opposition filed: 20020517
Change:	960320	A2	Designated Contracting States (change)
Search Report:	960515	A3	Separate publication of the European or International search report
Examination:	970102	A2	Date of filing of request for examination: 961104
*Assignee:	970917	A2	Applicant (transfer of rights) (change): Oce-Technologies B.V. (241033) St. Urbanusweg 43 5914 CC Venlo (NL) (applicant designated states: DE;FR;GB;IT;NL;SE)
*Assignee:	970917	A2	Previous applicant in case of transfer of rights (change): Oce-Nederland B.V. (241030) St. Urbanusweg 43 5914 CC Venlo (NL) (applicant designated states: DE;FR;GB;IT;NL;SE)
Examination:	990512	A2	Date of despatch of first examination report: 990329

Language (Publication, Procedural, Application): English; English; English

Specification:

EP 689157 A2

Apparatus for printing digital image data, comprising an operating unit provided with operating means, at least one inputting unit for receiving, from an external source, data files for printing, a memory device, a printing unit for printing image data files on an image support and a control unit, connected to the operating unit and also connected to the printing unit in order to have image data files in said memory device printed by the printing unit. Such data files for printing are normally supplied to the printer apparatus in coded form, that is a form which describes a document for printing in accordance with a page description language, such as Postscript, and also raster files (bitmaps) in compressed form, e.g. in accordance with run length compression.

An apparatus of this kind is known from International Patent Application No. WO 89/06024. In this known apparatus, data files supplied from an external source are stored in the memory and identification data and printing process specifications, such as the format of the printing paper, are extracted from each data file. A check is then made whether the apparatus settings for a given data file satisfy the said specifications. If so, the data file is immediately formated and printed. If not, an indication is given on the control panel to show that an operator must take action in order to have the apparatus satisfy the specifications. If the operator has completed that task, then the data file is printed immediately and automatically.

The disadvantage of the known apparatus is that the conventional workplace software (i.e. at the work station where the data file for printing is created) is only summarily provided with functionality for setting printing specifications. Many printers can in principle be equipped with all kinds of finishing functions, such as providing covers, stapling, interposing blank sheets, sorting, and so on, which are generally known from copying machines, but these are not adapted to operation from a standard work station program. In the case of specifications which can be operated from the work station, the operator may wish to change the finish or the appearance of the printing when he sees the print. In that case he has to return to his work station to change the specifications and then give a print order from there again.

Another disadvantage of direct printing of supplied data files is that the prints from different owners/senders are processed in the order of arrival and deposited in the machine tray or trays, so that the owner has to look for his prints amongst those of others.

The object of this invention is to provide a printing apparatus without the said disadvantages. To this end, at least for specific use, print jobs are always stored solely in the memory and printing is held up until the owner/sender of the data file gives a command for the purpose by means of a button on the printer.

To this end, the apparatus according to the invention is characterised in that said control unit is adapted to have any image data file printed when and only when it has received a print command for that purpose from an operator via said operating means.

In a first embodiment of the present invention, the inputting unit stores a received data file in the memory device, and only after said print command from the operating means is received, the control module has a received data file converted, by a processing unit for the purpose, into a printable image data file and printed by the printing unit.

In an alternative embodiment of the present invention, a data file received from the external source is immediately converted into a processed image data file, which is then stored in a storage device, but then printing is again held up until an operator command from the control panel of the printer. The processed image data may be directly suitable for printing without any further data processing, but may also have an intermediate format which can rapidly be processed into such directly suitable image data.

In either embodiment it is possible, without adapting the work station at which a document for printing has been prepared, to make prints with a special finish. In addition, the user can himself supervise the finishing of print jobs. This obviates trouble which is not unusual with conventional printers, for example because one's own print has to be looked for in a stack of prints of other users or because the order has not been executed because the stock of printing paper has been exhausted. If required, the apparatus can be so devised that after a data file has been printed the user can have the data file reprinted, but with different finishing specifications.

In a further embodiment of the apparatus according to the invention the control unit is provided with means for inventarising data files stored in the memory device and to present these data files via the operating unit to an operator for selection, and is adapted to have a data file as selected by an operator printed.

With this embodiment it is possible, even if different people use the printer, to supervise the stored data data files for printing.

Inputting units may be in the form of a network connection or a reader for data storage media, such as floppy disks.

The apparatus according to the invention can also be equipped with an electro-optical scanning unit or scanner by means of which a digital copying function is added to the printing function. In a combined copying and printing machine of this kind the operating concept according to the invention also offers the facility of executing both copying and print jobs on one machine in a clear and socially acceptable manner without annoying users, for example because when a user wishes to make a copy on the machine a printing job of another user (possibly far away) is just starting.

The invention will now be explained in detail with reference to the following description and the accompanying drawings wherein:

Fig. 1 is a diagram of an apparatus according to the invention;

Fig. 2 is a diagram of an electro-optical scanner as used in the apparatus of Fig. 1;

Fig. 3 is a diagram of an inputting device for digital image information from an external source as used in the device of Fig. 1;

Fig. 4 is a diagram of a printer unit as used in the apparatus shown in Fig. 1;

Fig. 5 is a diagram showing a central storage means as used in the apparatus of Fig. 1;

Figs. 6A and B show an control panel as used in the apparatus of Fig. 1;

Figs. 7 and 8 are flow diagrams describing the progress of the printing of digital image information.

Fig. 1 shows an image reproduction apparatus according to the invention. It comprises a scanning means 1 for the opto-electrical scanning of a document and for delivering digital image information corresponding thereto, an inputting means 2 for image information from an external source, and a printing unit 3 for printing digital image information on a support material.

Both the scanning unit 1 and the inputting unit 2 are connected to a central storage means 15 for image information, which is in turn connected to the printing unit 3. They are also connected to a central control unit 18, which is also connected to an operating unit 19 with operating elements and a VDU for use by an operator.

The scanning means 1 is shown in greater detail in Fig. 2. It is provided with a tubular lamp 5 and a reflector 6 co-operating therewith, to illuminate a narrow strip of a document 8 placed on window 7. The scanning means also comprises an array 10 of imaging glass fibres (a "selfoc-lens array") by means of which the light reflected by the document is projected on to a sensor array, e.g. a CCD array 12. During

scanning, the scanning means 1 is advanced by drive means known per se (not shown) at a uniform speed in the direction of arrow 13, so that the document 8 is scanned line-wise by the CCD array 12.

Thus each image dot of the document is converted to an analog signal corresponding to the grey scale value of that image dot. The analog signal is then converted by an A/D converter to a digital signal for each image dot, whereupon the digital signals (image data) are fed to an image processing device 14. In the latter the image data are subjected to one or more image processing operations known per se (thresholding, dithering, histogramming, enlargement, reduction, rotation, etc), to bring them into a form suitable for controlling the printing unit 3.

The scanning unit can also be provided with an automatic document feeder (ADF) not shown in the drawings. Units of this kind are generally known so that no detailed description is necessary.

The inputting unit 2 for digital image information from an external source, i.e., a front-end feeder, is shown in Fig. 3. This unit is provided with connection units to external data sources. A first connection is formed by a network connection unit 20 connected to an external network 16 to which a number of work stations can be connected for example. These work stations can transmit data files in various generally used formats (page description languages such as PCL, PostScript etc) via network 16 to have them printed. The technique of networks and sending data files over such networks is generally known and will therefore not be explained here.

The inputting unit 2 is also provided with a floppy disk unit 50 disposed in or in the vicinity of the apparatus and enabling users to have data files which are stored on a floppy disk printed. The floppy disc unit 50 is connected to a connection unit 21 of the front-end 2 for interpreting the signals from the unit 50.

The connections 20 and 21 are both connected to a job recognition module 22 which is in turn connected to a hard disc 23. Module 22 determines in respect of each data file supplied the page description language (PDL) in which it has been prepared and extracts identification data contained therein.

The memory disc 23, which is intended for interim storage of a supplied data file, is also connected to PDL interpreter 24 for converting a data file coded in a page description language into a form suitable for processing by the printer unit 3. The PDL interpreter 24 is connected via a buffer 25 to the central storage means 15. The job recognition module 22, the memory disc 23 and the PDL interpreter 24 are also each connected to the control unit 18.

For a description of the printing unit 3 reference will be made to Fig. 4. This apparatus is provided with an endless photoconductive belt 20, advanced in the direction of arrow 24 at a uniform speed by means of drive and guide rollers 21, 22 and 23 respectively.

By means of the processed image data presented from storage means 15 an LED array 25 is so controlled that the photoconductive belt 20 is exposed line-wise and image-wise after it has been electrostatically charged by a corona device 30.

The latent charge image forming on the belt 20 by the exposure is developed with toner powder by means of a magnetic brush device 31 to give a toner image which is then brought into contact with an endless intermediate medium belt 32 under pressure in a first transfer zone, belt 32 being made of or covered with an elastic and heat-resistant material, e.g. silicone rubber. In these conditions the toner image is transmitted by adhesion forces from the belt 20 to the belt 32. After this image transfer, any toner powder residues remaining are removed from the photoconductive belt 20 by means of a cleaning

device 33, whereafter the belt 20 is ready for fresh use.

The intermediate medium belt 32 is trained over drive and guide rollers 34, 35, belt 32 being heated in these conditions to a temperature above the softening temperature of the toner powder, e.g. by an infra-red radiator disposed inside roller 35. While the belt 32 with the toner image thereon is being advanced, the toner image becomes tacky as a result of the heating.

In a second transfer zone between the belt 32 and a pressure roller 36, the tacky toner image is transferred under the influence of pressure and simultaneously fixed on a copy sheet fed from one of the reservoirs 37 or 38.

The resulting copy can finally be deposited in a tray 39 or be fed by a defector element 40 (placed in the position indicated by broken lines) to an inverting device 41 in which the copy sheet is turned over, whereupon it is re-fed to the second transfer zone between the belt 32 and the pressure roller 36 in order to be printed with a powder image on the other side in said transfer zone and then deposited in the tray 39.

Fig. 4 shows only two copy sheet reservoirs 37 and 38 but of course the number of reservoirs can be expanded so that different formats of copy sheets (e.g. A5, A4 and A3 but also other e.g. American formats) can be presented. In addition, it is necessary to be able to present the different copy sheet formats in different orientations - namely longitudinal transport (with the longest peripheral side in the direction of transit) or transverse transport (with the shortest peripheral side in the direction of transit) so that copies of one and the same copy sheet format can be made with the image information orientation selectively in the direction of transit of the copy sheet through the printing apparatus or perpendicularly thereto.

The various parts of the printing apparatus 3 are controlled by the central control unit 18, either directly or by means of sub-control modules.

The central storage means 15 is shown in Fig. 5 and comprises an input multiplexer 40 in turn connected to the various signal sources, i.e. scanning unit 1 and inputting unit 2, and also to a data compression device 41. The latter is also connected to a memory 42 in turn connected to a data decompression device 43. The latter is also connected via a buffer circuit 44 to the printing apparatus 3. The memory 42 and the input multiplexer 40 are also connected to a control circuit 45 which is itself connected to the central control unit 18.

Image data supplied by the scanning unit 1 or inputting unit 2 are passed to compression device 41, in which for each scanned line of the document 8 the image data are compressed in a manner known from the art (e.g. run length coding). The compressed data are then stored in memory 42.

In this way, the image data of all the documents required for a given copying or printing job are stored line by line in memory 42. In this description, the term "document" denotes a page. A copying or print job may comprise a set of documents which may or may not belong together.

The start and end addresses of the image data of each document stored in the memory 42, inter alia, are updated in the control circuit 45 of the central storage means. After a set of documents of a copying or print job or part thereof has been stored in the memory 42 in the manner described, the various processing functions of the printing apparatus 3 can be started by the control unit 18. In these conditions, the latter orders the control circuit to read out of the memory 42 the image data required for the copying or print job, decompress them by decompression device 43, and feed them to the printing apparatus 3 for

processing to give a physical print.

The apparatus thus described is suitable for copying documents, by scanning them electro-optically and processing the resulting digital image data and printing the same. In addition, the apparatus can print digital data files supplied from an external source (either via the network or by means of a floppy disk), by interpreting such files and converting them into raster image data which are then passed to the printing apparatus. The operation of the two functions is largely identical. Both print jobs and copy jobs are executed only after a command for the purpose has been given on the machine control panel.

The procedure when a print job arrives via the network is as follows:

A data file for printing fed by a work station via the network is passed by the network connection unit 20 to the job recognition module 22. This extracts from the file a number of predetermined identification data, checks the file for recognition of the page description language (PDL) used, and passes these identification data and PDL to control unit 18. The file is then stored unchanged on memory disc 23, whereafter the apparatus passes into the stand-by condition.

In network systems, transmitted data files are always provided with identification data. These data usually contain the name of the sender (owner) and that of the file itself. In the case of print jobs, extra details are frequently added to specify specific settings of the printer. For example, in UNIX systems, a print job is in the form of a command file (for identification and specification) and a data file (for the data themselves for printing). The command file is intended for the UNIX process "line printer deamon" (lpd) which controls printing, but can also be read out by other processes. When the system according to the invention is implemented in a UNIX environment, the required identification data are read from the command file by the job recognition module 22. In this example, the extracted identification data comprise at least the name of the owner and the name of the file itself.

Control unit 18 manages a list containing the identification data of all data files for printing which are stored on memory disc 23. If a new file is transmitted via the network, then job recognition module 22 extracts the identification data therefrom and passes them to control unit 18. The latter adds these data to the list. Whenever a data file has been printed the control unit 18 removes the identification data of that file from the list.

If an operator now wishes to have a given data file printed, he must give a command for the purpose by means of the apparatus control panel 19. This panel is shown in Fig. 6A.

Panel 19 comprises a VDU 60, e.g. an image tube or an LCD display, and a number of buttons, namely a start button 61, numeric buttons 62, correction button 63 and selection buttons 64 - 70. When the apparatus is switched on the VDU 60 displays an image formed by a number of vertical columns each situated above one of the selection buttons 64 - 69. Each column relates to a specific basic function of the apparatus and shows the various possible settings for that basic function. For example, the leftmost column is allocated to the use of the printing paper, which can be printed on either one side or both sides. It can also be used to set a test print. The latter will be explained in detail hereinafter. The setting selected at any time, single-sided printing in this case, is indicated by a marker, such as a dark dot, or by highlighting.

An operator can select a different setting by actuating a selection button, e.g. in accordance with a cyclic diagram. As a result of a change of a setting, the function of one or more of the other selection buttons may change, because the old function is no longer relevant and other selection possibilities may be required. Different text applicable to the new function will then appear in the relevant column of the

VDU 60.

The selection button 70 offers the possibility of calling up another set of functions which cannot be displayed simultaneously with the above-discussed functions because of the limited dimensions of the VDU 60. Generally, these are functions which are not required for a single copying or print job, but which offer the operator more possibilities of obtaining special printing results, or functions which change the operation of the machine.

The columns above the buttons 64 (already mentioned), 65 (the sequence of the prints produced and possibly stapling) and 66 (the choice of printing paper) relate to the finishing of the order.

The column above button 67 relates to the nature of the original and shows the settings: "1-sided", "2-sided" and "digital". The first two possibilities relate to the copying function of the apparatus and specify the nature of the original. If one of these settings is selected, then the scanning means 1 becomes or remains the source of supply of digital image information activated by the control unit 18. In the "1-sided" setting, only the front of each original document is scanned while in the "2-sided" setting both sides are scanned consecutively. The columns above the buttons 68 and 69 relate to the enlargement setting and/or light/dark control. These functions are sufficiently known from the literature and will not be explained in detail here.

The VDU 60 also contains other fields 71 and 72. Field 71 is used to reproduce information concerning a data file for printing. This will be explained hereinafter. Field 72 indicates the number of prints set, as is generally customary on copying machines.

The procedure will now be explained when the setting "digital" is selected, this indicating that the operator wishes to print a data file previously transmitted via the network. In this connection we will refer to Figs. 7 and 8.

In response to selection of the setting "digital" (S1), the control unit 18 checks the list of files for printing and selects those in the owner's name. The control unit now gives the columns above buttons 68 and 69 a new function. The VDU 60 thus has the display shown in Fig. 6B (S2). The column above button 68 shows the names, initials, or other identifications of owners, possibly in abbreviated form, which occur in the said list, while the column above button 69 gives the various data files of the owner selected in the left-hand column, possibly in abbreviated form. The first owner and his first file in the list are initially preselected. However, the operator can now select a different owner (S3) by means of the buttons 68. The control unit 18 then fills the column above button 69 with the names of the files of the selected owner in the list (S4), the first file in the list being preselected from those files. Once again the operator can make a different choice with button 69 (S6). More names can be displayed than fit in the column by scrolling. If the operator does not make a selection, then of course the preselected owner and file name are maintained (S5, S7). The complete name of the selected data file is shown in a separate part 71 of the VDU 60.

A data file may be provided with control data relating to the finishing of the prints, e.g. a specific number of prints, stapling of the set of prints, and format of the printing paper. Under UNIX, for example, such data can be selected as an addition to the print command and they are then included in the command file already mentioned. These data are recognised by the job recognition module 22, separated from the data for printing, and transmitted to the control module 18, which includes them as extra information in the list of data files for printing. When the operator selects a given data file, the control unit 18 adjusts the apparatus in accordance with the control data S8 transmitted and shows them on the VDU 60 of the control panel 19 in the columns above the buttons 64, 65 and 66. However, the operator

can select different settings on the control panel before pressing the "start" button 61 (S9). In that case the prints are carried out in accordance with these last settings (S10).

By actuating the "start" button 61 the operator then gives the command for the data file selected as described above to be printed (S11). In response, the control unit 18 gives the PDL interpreter 24 the order to bring up the relevant file from the memory disc 23 (S12), convert it to a printable form (S13) and store it page by page via the buffer 25 in the central storage means 15 (more specifically memory 42, S14). For the purpose of an accounting system in which prints have to be accounted for per sheet by means of an automatic payment unit or by debiting from a group budget, the control unit 18 can access the central memory on each transfer of a converted page. In this embodiment the control unit 18 gives a command for each transfer, after checking whether the automatic payment unit or budget have sufficient credit for the printing (possibly in a plurality of copies if so set) of said page.

As soon as the central storage means 15 contains sufficient data for printing of the first page (S15), the printing unit 3 is started (S16) and prints the file on paper in accordance with the selected machine settings.

The apparatus is also adapted first to make a test print or proof for a print job in which a file has to be printed a number of times, in order that the appearance of the resulting print may be assessed. Normally, after completion of a print job the data file is automatically erased from the memory 42 of the central storage means 15, but when a proof is taken this is not the case, so that the file remains available (and selected) for printing, if required after different finish settings have been selected.

Making a proof is a function which can be selected by selecting the option "proof" by means of button 64 on the control panel 19.

The apparatus can also be provided with an access control to the list of stored files. This is intended for users who regularly wish to print confidential information. In that case, the control unit 18 can be provided with a password check, which is programmable by means of functions which can be called up via button 70 on the control panel. For certain programmed owners' names, no names of stored files are shown in the column above button 69. If such an owner's name is selected in the column above button 68, control unit. 18 asks for an access code via a message in part 71 of the VDU. After the operator has keyed in this code by means of the numeric keys 62, the control unit 18 checks this code with the preprogrammed code stored in a memory for the associated owner's name and, in the event of agreement, it displays the files stored for that owner on memory disc 23 in the column above button 69 and enables them to be selected.

For printing data files from a floppy disk, the procedure is as follows. If a user wishes to have a data file printed from a floppy disk, he inserts the floppy disk in unit 50. This detects the presence of the floppy disk and gives a signal to the control unit 18, which instructs the unit 50 to read out the floppy disk and automatically select the "digital" original setting in the column above button 67 on control panel 19. The data read out are passed via connection unit 21 to job recognition module 22, which extracts the identification data from the read data files (the floppy disk may contain more than one file), whereafter the files themselves are stored unchanged on memory disc 23. The identification data of the files on the floppy disk are included by control unit 18 in its already written list of data files for printing. The term "floppy" is now included in the column above button 68 on the control panel (Fig. 6B) and automatically preselected. In the column above button 69 the name of the data file or, if the floppy disk contained more than one data file, the names of all these files are displayed, the first thereof being preselected. By pressing the start button 61 the operator then gives the order for the selected file to be printed. The procedure is exactly the same as that in the above-described treatment of data files transmitted via the

network. Of course, the operator can depart from the selection made by the machine by selecting a different file for printing by means of buttons 68 and 69. Of course, the apparatus can also be made suitable for reading out other digital information media, such as optical disks. Processing of data files thereon will be in a similar manner.

In an alternative embodiment, the unit 50 can read out only the data content of the floppy disk without transferring the image data themselves to the memory disc 23. The content data are then passed via job recognition module 22 to control unit 18, which includes them in the said list and presents them to the operator. Only when the operator has selected a data file thus presented, is the file really read out from the floppy disk, transferred to the memory disc 23, rasterised and printed.

Both columns for selection of a data file for printing (the columns above buttons 68 and 69) also contain a designation "all". When these two settings are made, the control unit arranges the printing of all the data files in the list as stored on the memory disc, in response to a start command, printing being in a sequence such that all the files occurring in the list are printed successively for the next owner. This is convenient for batch printing of print jobs collected on the memory disc 23, because the sets of prints can in this way be deposited in a clearly observed arrangement.

In a second major embodiment of the present invention, print jobs are, upon their reception, immediately converted to a printable form and stored in a memory, after which the apparatus passes into a stand-by condition. This same modification may also be used for the floppy disk printing mode.

The apparatus of this embodiment has essentially the same components as the one described above in relation to Fig.s 1 to 6B, and most of their functions are also the same as above. However, a data file for printing is now passed to the PDL interpreter 24 immediately, with the memory disc 23 being used for spooling only. The PDL interpreter 24 converts the data file to a printable form, stores the results via buffer 25 in the central storage means 15, and signals the finishing of its job to the control unit 18. The latter, which has already added the identification data of the job to its list but has not yet made said data available for presentation on the VDU 60 of the control panel 19, now makes the data available and selectable for an operator.

Upon actuation of the "start" button 61, the control module 18 starts up the printing unit 3 for printing the selected data file in storage means 15 on paper in accordance with the selected machine settings.

It will be understood that especially for the second embodiment described herein the memory 42 of central storage means 15 should preferably be of large capacity, for instance a hard disc unit or a combination of a semiconductor memory and a disc unit. On the other hand, this embodiment has the advantage of a faster print job handling once the "start" button has been pressed, because the conversion of the data has already taken place.

In a third major embodiment, the data of a received print job are immediately converted into an intermediate format, which takes less storage space and yet can be converted into printable data in very little time. Said intermediate format data are formed by PDL interpreter 24 and may be stored on memory disc 23. No further action follows until an operator selects a file and presses the "start" button 61. Then, a further module of PDL interpreter 24 processes the file into printable form and passes the results to printing unit 3 for printing.

The machine thus described is also adapted to be set to a state in which it behaves as a conventional network printer sequentially finishing all the print jobs arriving via the network. A data file for printing is passed by the network connection unit 20 to the job recognition module 22, which extracts from the

file the identification data and the PDL used for the purposes of a banner page which is added as the first page to a print set. The job recognition module 22 passes the extracted information to control unit 18 and then sends the file unchanged for storage on memory disc 23. The PDL interpreter 24 is set by the control unit 18 to the PDL used and then on command converts the file into printable image data and transmits them page-wise, via buffer 25, to the central storage means 15. In these conditions, the first page transmitted is the banner page with the data extracted by job recognition module 22. On command from the control unit 18 the printing unit 3 prints the pages on sheets of paper.

In this condition of the machine, copying and printing from a floppy disk in unit 50 is blocked. This condition can be set by means of a selection function on the control panel, such function being called up by the button 70. If required, a switch can also be used for this selection.

The apparatus can also be so devised that for some owners (senders) the print jobs are finished immediately while for other owners the data files are stored and are not printed until a command for this is given from the control panel. In this construction the control unit 18 is provided with a list of owners' names stored in the memory and, for each owner's name, the required procedure for print jobs. On arrival of a print job, the control unit 18 compares the identification data transmitted by job recognition module 22 with the said list of owners' names and then determines what is to be done with a print job received. The content of the list can be input by a function on the control panel called up via button 70.

In order to prevent data files supplied via the network and forgotten by their owner from continuing to occupy space unnecessarily on the memory disc 23, the apparatus can be provided with a retention time control, which automatically removes a file from the disk after expiry of a predetermined period, e.g. a day, after it has been supplied. The retention period can, of course, be programmable, with different periods for each owner if required.

Although the invention has been explained by reference to the apparatus described above, it is not restricted thereto. Numerous other embodiments are possible within the scope of the claims and these are considered as coming under the scope of protection.

Specification:

EP 689157 B1

The invention relates to a network printer for connection to a network system including a plurality of workstations, for printing digital print files generated by a document editing application running in a workstation and including a printer driver, said printer comprising a local operating unit provided with operating means such as a control panel with keys and a display; a memory device; an inputting unit, including a network connection unit, for receiving print files owned by different ones of a plurality of users, from said work stations and storing the same in said memory device; a printing unit for printing print files on image supports; and a control unit, connected to the operating unit, the inputting unit and the printing unit for controlling printing print files stored in said memory device by the printing unit.

Such data files for printing are normally supplied to the printer apparatus in coded form, that is a form which describes a document for printing in accordance with a page description language, such as Postscript.

An apparatus of this kind is known from International Patent Application No. WO 89/06024. In this known apparatus, data files supplied from an external source are stored in the memory and identification data and printing process specifications, such as the format of the printing paper, are extracted from each

data file. A check is then made whether the apparatus settings for a given data file satisfy the said specifications. If so, the data file is immediately formated and printed. If not, an indication is given on the control panel to show that an operator must take action in order to have the apparatus satisfy the specifications. If the operator has completed that task, then the data file is printed immediately and automatically.

A disadvantage of the direct printing of supplied data files in the known apparatus is that the prints from different owners/senders are processed in the order of arrival and deposited in the machine tray or trays, so that the owner has to look for his prints amongst those of others.

JP-A-6 133 124 discloses a network printer incuding a so-called security-print function. Security-print files are transmitted to the printer together with a security code, and the printer stores the print file without printing them. After sending a security-print file to the printer, the owner of the print file goes to the printer and enters the security code at the printer control panel. In reaction, the printer checks whether it has received and stored a print file carrying that security code, and prints the file.

In this known apparatus, print files are only printed upon a print command from the printer control panel.

Another disadvantage of direct printing of supplied data files is that the conventional workplace software (i.e. at the work station where the data file for printing is created) is only summarily provided with functionality for setting printing specifications. Many printers can in principle be equipped with all kinds of finishing functions, such as providing covers, stapling, interposing blank sheets, sorting, and so on, which are generally known from copying machines, but these are not adapted to operation from a standard work station program. In the case of specifications which can be operated from the work station, the operator may wish to change the finish or the appearance of the printing when he sees the print. In that case he has to return to his work station to change the specifications and then give a print order from there again.

The object of this invention is to provide a network printer, i.e. a printer shared by a plurality of users giving the owners of print files the opportunity to directly control the printing of their files. In order to achieve this, a first purpose of the invention is to give a user a simple and convenient means to print his files under his own supervision, that is, in his presence.

To this end, the apparatus according to the invention is characterised in that said inputting unit is provided with means for extracting identification data from a received print file and is connected to said control unit for transmitting said identification data thereto, said control unit is provided with means for inventarising said identification data of received print files stored in the memory device and to present said identification data, including, for each print file, an identification of the owner, via the operating unit to an operator for selection, said local operating unit is adapted to report a selection of a print file and a print command, both of them made by an operator using the operating means, to the control unit, and said control unit is further adapted to have any print file printed by the printing unit only upon reception of said selection and print command from the operating unit.

In this way, a print file is not printed unless the owner starts the print process at the printer after having specified which one of the stored print files he wants. In order to make a selection of a print file from the collection of stored print files possible, the operator is given an overview of all stored print files.

Consequently, the user does not have to remember a code, and since his name is displayed together with the other identification data of the print file, it is very easy for him to find his print file(s) between those

of other users, that is, print files not intended for him.

In a preferred embodiment, the control unit is adapted to present said identification data of print files, sorted according to the owners. This makes finding one's own print files among those of others even simpler.

In this way, the user can himself supervise the printing of print jobs. This obviates trouble which is not unusual with conventional printers, for example because one's own print has to be looked for in a stack of prints of other users or because the order has not been executed because the stock of printing paper has been exhausted.

In an embodiment of the present invention, the inputting unit stores a received data file in the memory device, and only after said print command from the operating means is received, the control module has a received data file converted, by a processing unit for the purpose, into a printable image data file and printed by the printing unit.

In an alternative embodiment of the present invention, a data file received from the external source is immediately converted into a processed image data file, which is then stored in a storage device, but then printing is again held up until an operator command from the control panel of the printer. The processed image data may be directly suitable for printing without any further data processing, but may also have an intermediate format which can rapidly be processed into such directly suitable image data.

It should be noted that JP-A-4 317 251 discloses a facsimile printer that does not print received fax message immediately, but stores them in a memory, extracts the name of the sender and his telephone number, and shows these data in list. The fax operator may then select separate fax messages for printing or deletion. The purpose of this feature is to prevent unwanted fax messages (e.g. advertisements) from being printed. Facsimile is a communication means used by plural senders equipped with a scanner, to address one receiver equipped with a printer, and its application field is quite different from a digital environment in which workers prepare and edit documents with a document editing application and have these printed on a shared printer. In the latter environment, print files are each owned by one individual out of a plurality of users, who all use the printer for their own purpose.

In a more elaborated form of the invention, it is possible, without adapting the work station at which a document for printing has been prepared, to make prints with a special finish.

This is achieved in that the operating unit is also adapted to present printing specifications for selection to an operator and is adapted to report a selection of printing specifications together with said selection of a print file and said print command to the control unit, and in that the control unit is adapted to have a selected print file printed by the printing unit in accordance with the selected printing specifications. Print files may also include printing specifications, and in a further embodiment, these are used for preprogramming the printer and are also shown on the operating panel display, so that the operator may change them.

If required, the apparatus can be so devised that after a data file has been printed the user can have the data file reprinted, but with different finishing specifications.

Inputting units may be in the form of a network connection or a reader for data storage media, such as floppy disks.

The apparatus according to the invention can also be equipped with an electro-optical scanning unit or

scanner by means of which a digital copying function is added to the printing function. In a combined copying and printing machine of this kind the operating concept according to the invention also offers the facility of executing both copying and print jobs on one machine in a clear and socially acceptable manner without annoying users, for example because when a user wishes to make a copy on the machine a printing job of another user (possibly far away) is just starting.

The invention will now be explained in detail with reference to the following description and the accompanying drawings wherein:

Fig. 1 is a diagram of an apparatus according to the invention;.

Fig. 2 is a diagram of an electro-optical scanner as used in the apparatus of Fig. 1;

Fig. 3 is a diagram of an inputting device for digital image information from an external source as used in the device of Fig. 1;

Fig. 4 is a diagram of a printer unit as used in the apparatus shown in Fig. 1;

Fig. 5 is a diagram showing a central storage means as used in the apparatus of Fig. 1;

Figs. 6A and B show an control panel as used in the apparatus of Fig. 1;

Figs. 7 and 8 are flow diagrams describing the progress of the printing of digital image information.

Fig. 1 shows an image reproduction apparatus according to the invention. It comprises a scanning means 1 for the opto-electrical scanning of a document and for delivering digital image information corresponding thereto, an inputting means 2 for image information from an external source and a printing unit 3 for printing digital image information on a support material.

Both the scanning unit 1 and the inputting unit 2 are connected to a central storage means 15 for image information, which is in turn connected to the printing unit 3. They are also connected to a central control unit 18, which is also connected to an operating unit 19 with operating elements and a VDU for use by an operator.

The scanning means 1 is shown in greater detail in Fig. 2. It is provided with a tubular lamp 5 and a reflector 6 co-operating therewith, to illuminate a narrow strip of a document 8 placed on window 7. The scanning means also comprises an array 10 of imaging glass fibres (a "selfoc-lens array") by means of which the light reflected by the document is projected on to a sensor array, e.g. a CCD array 12. During scanning, the scanning means 1 is advanced by drive means known per se (not shown) at a uniform speed in the direction of arrow 13, so that the document 8 is scanned line-wise by the CCD array 12.

Thus each image dot of the document is converted to an analog signal corresponding to the grey scale value of that image dot. The analog signal is then converted by an A/D converter to a digital signal for each image dot, whereupon the digital signals (image data) are fed to an image processing device 14. In the latter the image data are subjected to one or more image processing operations known per se (thresholding, dithering, histogramming, enlargement, reduction, rotation, etc), to bring them into a form suitable for controlling the printing unit 3.

The scanning unit can also be provided with an automatic document feeder (ADF) not shown in the drawings. Units of this kind are generally known so that no detailed description is necessary.

The inputting unit 2 for digital image information from an external source, i.e., a front-end feeder, is shown in Fig. 3. This unit is provided with connection units to external data sources. A first connection is formed by a network connection unit 20 connected to an external network 16 to which a number of work stations can be connected for example. These work stations can transmit data files in various generally used formats (page description languages such as PCL, PostScript etc) via network 16 to have them printed. The technique of networks and sending data files over such networks is generally known and will therefore not be explained here.

The inputting unit 2 is also provided with a floppy disk unit 50 disposed in or in the vicinity of the apparatus and enabling users to have data files which are stored on a floppy disk printed. The floppy disc unit 50 is connected to a connection unit 21 of the front-end 2 for interpreting the signals from the unit 50.

The connections 20 and 21 are both connected to a job recognition module 22 which is in turn connected to a hard disc 23. Module 22 determines in respect of each data file supplied the page description language (PDL) in which it has been prepared and extracts identification data contained therein.

The memory disc 23, which is intended for interim storage of a supplied data file, is also connected to PDL interpreter 24 for converting a data file coded in a page description language into a form suitable for processing by the printer unit 3. The PDL interpreter 24 is connected via a buffer 25 to the central storage means 15. The job recognition module 22, the memory disc 23 and the PDL interpreter 24 are also each connected to the control unit 18.

For a description of the printing unit 3 reference will be made to Fig. 4. This apparatus is provided with an endless photoconductive belt 20, advanced in the direction of arrow 24 at a uniform speed by means of drive and guide rollers 21, 22 and 23 respectively.

By means of the processed image data presented from storage means 15 an LED array 25 is so controlled that the photoconductive belt 20 is exposed line-wise and image-wise after it has been electrostatically charged by a corona device 30.

The latent charge image forming on the belt 20 by the exposure is developed with toner powder by means of a magnetic brush device 31 to give a toner image which is then brought into contact with an endless intermediate medium belt 32 under pressure in a first transfer zone, belt 32 being made of or covered with an elastic and heat-resistant material, e.g. silicone rubber. In these conditions the toner image is transmitted by adhesion forces from the belt 20 to the belt 32. After this image transfer, any toner powder residues remaining are removed from the photoconductive belt 20 by means of a cleaning device 33, whereafter the belt 20 is ready for fresh use.

The intermediate medium belt 32 is trained over drive and guide rollers 34, 35, belt 32 being heated in these conditions to a temperature above the softening temperature of the toner powder, e.g. by an infra-red radiator disposed inside roller 35. While the belt 32 with the toner image thereon is being advanced, the toner image becomes tacky as a result of the heating.

In a second transfer zone between the belt 32 and a pressure roller 36, the tacky toner image is transferred under the influence of pressure and simultaneously fixed on a copy sheet fed from one of the reservoirs 37 or 38.

The resulting copy can finally be deposited in a tray 39 or be fed by a deflector element 40 (placed in the

position indicated by broken lines) to an inverting device 41 in which the copy sheet is turned over, whereupon it is re-fed to the second transfer zone between the belt 32 and the pressure roller 36 in order to be printed with a powder image on the other side in said transfer zone and then deposited in the tray 39.

Fig. 4 shows only two copy sheet reservoirs 37 and 38 but of course the number of reservoirs can be expanded so that different formats of copy sheets (e.g. A5, A4 and A3 but also other e.g. American formats) can be presented. In addition, it is necessary to be able to present the different copy sheet formats in different orientations - namely longitudinal transport (with the longest peripheral side in the direction of transit) or transverse transport (with the shortest peripheral side in the direction of transit) so that copies of one and the same copy sheet format can be made with the image information orientation selectively in the direction of transit of the copy sheet through the printing apparatus or perpendicularly thereto.

The various parts of the printing apparatus 3 are controlled by the central control unit 18, either directly or by means of sub-control modules.

The central storage means 15 is shown in Fig. 5 and comprises an input multiplexer 40 in turn connected to the various signal sources, i.e. scanning unit 1 and inputting unit 2, and also to a data compression device 41. The latter is also connected to a memory 42 in turn connected to a data decompression device 43. The latter is also connected via a buffer circuit 44 to the printing apparatus 3. The memory 42 and the input multiplexer 40 are also connected to a control circuit 45 which is itself connected to the central control unit 18.

Image data supplied by the scanning unit 1 or inputting unit 2 are passed to compression device 41, in which for each scanned line of the document 8 the image data are compressed in a manner known from the art (e.g. run length coding). The compressed data are then stored in memory 42.

In this way, the image data of all the documents required for a given copying or printing job are stored line by line in memory 42. In this description, the term "document" denotes a page. A copying or print job may comprise a set of documents which may or may not belong together.

The start and end addresses of the image data of each document stored in the memory 42, inter alia, are updated in the control circuit 45 of the central storage means. After a set of documents of a copying or print job or part thereof has been stored in the memory 42 in the manner described, the various processing functions of the printing apparatus 3 can be started by the control unit 18. In these conditions, the latter orders the control circuit to read out of the memory 42 the image data requiredfor the copying or print job, decompress them by decompression device 43, and feed them to the printing apparatus 3 for processing to give a physical print.

The apparatus thus described is suitable for copying documents, by scanning them electro-optically and processing the resulting digital image data and printing the same. In addition, the apparatus can print digital data files supplied from an external source (either via the network or by means of a floppy disk), by interpreting such files and converting them into raster image data which are then passed to the printing apparatus. The operation of the two functions is largely identical. Both print jobs and copy jobs are executed only after a command for the purpose has been given on the machine control panel.

The procedure when a print job arrives via the network is as follows:

A data file for printing fed by a work station via the network is passed by the network connection unit 20

to the job recognition module 22. This extracts from the file a number of predetermined identification data, checks the file for recognition of the page description language (PDL) used, and passes these identification data and PDL to control unit 18. The file is then stored unchanged on memory disc 23, whereafter the apparatus passes into the stand-by condition.

In network systems, transmitted data files are always provided with identification data. These data usually contain the name of the sender (owner) and that of the file itself. In the case of print jobs, extra details are frequently added to specify specific settings of the printer. For example, in UNIX systems, a print job is in the form of a command file (for identification and specification) and a data file (for the data themselves for printing). The command file is intended for the UNIX process "line printer deamon" (lpd) which controls printing, but can also be read out by other processes. When the system according to the invention is implemented in a UNIX environment, the required identification data are read from the command file by the job recognition module 22. In this example, the extracted identification data comprise at least the name of the owner and the name of the file itself.

Control unit 18 manages a list containing the identification data of all data files for printing which are stored on memory disc 23. If a new file is transmitted via the network, then job recognition module 22 extracts the identification data therefrom and passes them to control unit 18. The latter adds these data to the list. Whenever a data file has been printed the control unit 18 removes the identification data of that file from the list.

If an operator now wishes to have a given data file printed, he must give a command for the purpose by means of the apparatus control panel 19. This panel is shown in Fig. 6A.

Panel 19 comprises a VDU 60, e.g. an image tube or an LCD display, and a number of buttons, namely a start button 61, numeric buttons 62, correction button 63 and selection buttons 64 - 70. When the apparatus is switched on the VDU 60 displays an image formed by a number of vertical columns each situated above one of the selection buttons 64 - 69. Each column relates to a specific basic function of the apparatus and shows the various possible settings for that basic function. For example, the leftmost column is allocated to the use of the printing paper, which can be printed on either one side or both sides. It can also be used to set a test print. The latter will be explained in detail hereinafter. The setting selected at any time, single-sided printing in this case, is indicated by a marker, such as a dark dot, or by highlighting.

An operator can select a different setting by actuating a selection button, e.g. in accordance with a cyclic diagram. As a result of a change of a setting, the function of one or more of the other selection buttons may change, because the old function is no longer relevant and other selection possibilities may be required. Different text applicable to the new function will then appear in the relevant column of the VDU 60.

The selection button 70 offers the possibility of calling up another set of functions which cannot be displayed simultaneously with the above-discussed functions because of the limited dimensions of the VDU 60. Generally, these are functions which are not required for a single copying or print job, but which offer the operator more possibilities of obtaining special printing results, or functions which change the operation of the machine.

The columns above the buttons 64 (already mentioned), 65 (the sequence of the prints produced and possibly stapling) and 66 (the choice of printing paper) relate to the finishing of the order.

The column above button 67 relates to the nature of the original and shows the settings: "1-sided",

"2-sided" and "digital". The first two possibilities relate to the copying function of the apparatus and specify the nature of the original. If one of these settings is selected, then the scanning means 1 becomes or remains the source of supply of digital image information activated by the control unit 18. In the "1-sided" setting, only the front of each original document is scanned while in the "2-sided" setting both sides are scanned consecutively. The columns above the buttons 68 and 69 relate to the enlargement setting and/or light/dark control. These functions are sufficiently known from the literature and will not be explained in detail here.

The VDU 60 also contains other fields 71 and 72. Field 71 is used to reproduce information concerning a data file for printing. This will be explained hereinafter. Field 72 indicates the number of prints set, as is generally customary on copying machines.

The procedure will now be explained when the setting "digital" is selected, this indicating that the operator wishes to print a data file previously transmitted via the network. In this connection we will refer to Figs. 7 and 8.

In response to selection of the setting "digital" (S1), the control unit 18 checks the list of files for printing and selects those in the owner's name. The control unit now gives the columns above buttons 68 and 69 a new function. The VDU 60 thus has the display shown in Fig. 6B (S2). The column above button 68 shows the names, initials, or other identifications of owners, possibly in abbreviated form, which occur in the said list, while the column above button 69 gives the various data files of the owner selected in the left-hand column, possibly in abbreviated form. The first owner and his first file in the list are initially preselected. However, the operator can now select a different owner (S3) by means of the buttons 68. The control unit 18 then fills the column above button 69 with the names of the files of the selected owner in the list (S4), the first file in the list being preselected from those files. Once again the operator can make a different choice with button 69 (S6). More names can be displayed than fit in the column by scrolling. If the operator does not make a selection, then of course the preselected owner and file name are maintained (S5, S7). The complete name of the selected data file is shown in a separate part 71 of the VDU 60.

A data file may be provided with control data relating to the finishing of the prints, e.g. a specific number of prints, stapling of the set of prints, and format of the printing paper. Under UNIX, for example, such data can be selected as an addition to the print command and they are then included in the command file already mentioned. These data are recognised by the job recognition module 22, separated from the data for printing, and transmitted to the control module 18, which includes them as extra information in the list of data files for printing. When the operator selects a given data file, the control unit 18 adjusts the apparatus in accordance with the control data S8 transmitted and shows them on the VDU 60 of the control panel 19 in the columns above the buttons 64, 65 and 66. However, the operator can select different settings on the control panel before pressing the "start" button 61 (S9). In that case the prints are carried out in accordance with these last settings (S10).

By actuating the "start" button 61 the operator then gives the command for the data file selected as described above to be printed (S11). In response, the control unit 18 gives the PDL interpreter 24 the order to bring up the relevant file from the memory disc 23 (S12), convert it to a printable form (S13) and store it page by page via the buffer 25 in the central storage means 15 (more specifically memory 42, S14). For the purpose of an accounting system in which prints have to be accounted for per sheet by means of an automatic payment unit or by debiting from a group budget, the control unit 18 can access the central memory on each transfer of a converted page. In this embodiment the control unit 18 gives a command for each transfer, after checking whether the automatic payment unit or budget have sufficient credit for the printing (possibly in a plurality of copies if so set) of said page.

As soon as the central storage means 15 contains sufficient data for printing of the first page (S15), the printing unit 3 is started (S16) and prints the file on paper in accordance with the selected machine settings.

The apparatus is also adapted first to make a test print or proof for a print job in which a file has to be printed a number of times, in order that the appearance of the resulting print may be assessed. Normally, after completion of a print job the data file is automatically erased from the memory 42 of the central storage means 15, but when a proof is taken this is not the case, so that the file remains available (and selected) for printing, if required after different finish settings have been selected.

Making a proof is a function which can be selected by selecting the option "proof" by means of button 64 on the control panel 19.

The apparatus can also be provided with an access control to the list of stored files. This is intended for users who regularly wish to print confidential information. In that case, the control unit 18 can be provided with a password check, which is programmable by means of functions which can be called up via button 70 on the control panel. For certain programmed owners' names, no names of stored files are shown in the column above button 69. If such an owner's name is selected in the column above button 68, control unit 18 asks for an access code via a message in part 71 of the VDU. After the operator has keyed in this code by means of the numeric keys 62, the control unit 18 checks this code with the preprogrammed code stored in a memory for the associated owner's name and, in the event of agreement, it displays the files stored for that owner on memory disc 23 in the column above button 69 and enables them to be selected.

For printing data files from a floppy disk, the procedure is as follows. If a user wishes to have a data file printed from a floppy disk, he inserts the floppy disk in unit 50. This detects the presence of the floppy disk and gives a signal to the control unit 18, which instructs the unit 50 to read out the floppy disk and automatically select the "digital" original setting in the column above button 67 on control panel 19. The data read out are passed via connection unit 21 to job recognition module 22, which extracts the identification data from the read data files (the floppy disk may contain more than one file), whereafter the files themselves are stored unchanged on memory disc 23. The identification data of the files on the floppy disk are included by control unit 18 in its already written list of data files for printing. The term "floppy" is now included in the column above button 68 on the control panel (Fig. 6B) and automatically preselected. In the column above button 69 the name of the data file or, if the floppy disk contained more than one data file, the names of all these files are displayed, the first thereof being preselected. By pressing the start button 61 the operator then gives the order for the selected file to be printed. The procedure is exactly the same as that in the above-described treatment of data files transmitted via the network. Of course, the operator can depart from the selection made by the machine by selecting a different file for printing by means of buttons 68 and 69. Of course, the apparatus can also be made suitable for reading out other digital information media, such as optical disks. Processing of data files thereon will be in a similar manner.

In an alternative embodiment, the unit 50 can read out only the data content of the floppy disk without transferring the image data themselves to the memory disc 23. The content data are then passed via job recognition module 22 to control unit 18, which includes them in the said list and presents them to the operator. Only when the operator has selected a data file thus presented, is the file really read out from the floppy disk, transferred to the memory disc 23, rasterised and printed.

Both columns for selection of a data file for printing (the columns above buttons 68 and 69) also contain

a designation "all". When these two settings are made, the control unit arranges the printing of all the data files in the list as stored on the memory disc, in response to a start command, printing being in a sequence such that all the files occurring in the list are printed successively for the next owner. This is convenient for batch printing of print jobs collected on the memory disc 23, because the sets of prints can in this way be deposited in a clearly observed arrangement.

In a second major embodiment of the present invention, print jobs are, upon their reception, immediately converted to a printable form and stored in a memory, after which the apparatus passes into a stand-by condition. This same modification may also be used for the floppy disk printing mode.

The apparatus of this embodiment has essentially the same components as the one described above in relation to Fig.s 1 to 6B, and most of their functions are also the same as above. However, a data file for printing is now passed to the PDL interpreter 24 immediately, with the memory disc 23 being used for spooling only. The PDL interpreter 24 converts the data file to a printable form, stores the results via buffer 25 in the central storage means 15, and signals the finishing of its job to the control unit 18. The latter, which has already added the identification data of the job to its list but has not yet made said data available for presentation on the VDU 60 of the control panel 19, now makes the data available and selectable for an operator.

Upon actuation of the "start" button 61, the control module 18 starts up the printing unit 3 for printing the selected data file in storage means 15 on paper in accordance with the selected machine settings.

It will be understood that especially for the second embodiment described herein the memory 42 of central storage means 15 should preferably be of large capacity, for instance a hard disc unit or a combination of a semiconductor memory and a disc unit. On the other hand, this embodiment has the advantage of a faster print job handling once the "start" button has been pressed, because the conversion of the data has already taken place.

In a third major embodiment, the data of a received print job are immediately converted into an intermediate format, which takes less storage space and yet can be converted into printable data in very little time. Said intermediate format data are formed by PDL interpreter 24 and may be stored on memory disc 23. No further action follows until an operator selects a file and presses the "start" button 61. Then, a further module of PDL interpreter 24 processes the file into printable form and passes the results to printing unit 3 for printing.

The machine thus described is also adapted to be set to a state in which it behaves as a conventional network printer sequentially finishing all the print jobs arriving via the network. A data file for printing is passed by the network connection unit 20 to the job recognition module 22, which extracts from the file the identification data and the PDL used for the purposes of a banner page which is added as the first page to a print set. The job recognition module 22 passes the extracted information to control unit 18 and then sends the file unchanged for storage on memory disc 23. The PDL interpreter 24 is set by the control unit 18 to the PDL used and then on command converts the file into printable image data and transmits them page-wise, via buffer 25, to the central storage means 15. In these conditions, the first page transmitted is the banner page with the data extracted by job recognition module 22. On command from the control unit 18 the printing unit 3 prints the pages on sheets of paper.

In this condition of the machine, copying and printing from a floppy disk in unit 50 is blocked. This condition can be set by means of a selection function on the control panel, such function being called up by the button 70. If required, a switch can also be used for this selection.

The apparatus can also be so devised that for some owners (senders) the print jobs are finished immediately while for other owners the data files are stored and are not printed until a command for this is given from the control panel. In this construction the control unit 18 is provided with a list of owners' names stored in the memory and, for each owner's name, the required procedure for print jobs. On arrival of a print job, the control unit 18 compares the identification data transmitted by job recognition module 22 with the said list of owners' names and then determines what is to be done with a print job received. The content of the list can be input by a function on the control panel called up via button 70.

In order to prevent data files supplied via the network and forgotten by their owner from continuing to occupy space unnecessarily on the memory disc 23, the apparatus can be provided with a retention time control, which automatically removes a file from the disk after expiry of a predetermined period, e.g. a day, after it has been supplied. The retention period can, of course, be programmable, with different periods for each owner if required.

Although the invention has been explained by reference to the apparatus described above, it is not restricted thereto. Numerous other embodiments are possible within the scope of the claims and these are considered as coming under the scope of protection.

Claims:

EP 689157 A2

1. Apparatus for printing digital image data, comprising an operating unit provided with operating means;

at least one inputting unit for receiving, from an external source, data files for printing;

a memory device;

a printing unit for printing image data files on an image support; and

a control unit, connected to the operating unit and also connected to the printing unit in order to have image data files in said memory device printed by the printing unit;

characterized in that

said control unit is adapted to have any image data file printed when and only when it has received a print command for that purpose from an operator via said operating means.

2. Apparatus according to claim 1,

further comprising a processing unit for converting received data files into printable image data files,

wherein said inputting unit is adapted to store a received data file in said memory device

and wherein said control unit is adapted to, upon said print command from the operating means, have a received data file converted by said processing unit and have the resulting printable image data file printed by said printing unit.

3. Apparatus according to claim 2, characterized in that

said control unit is provided with means for inventarising received data files stored in the memory device and to present identification data of these data files via the operating unit to an operator for selection,

and in that the control unit is adapted to have converted and printed, on the said print command, a data file stored in the memory device as selected by the operator prior said print command.

4. Apparatus according to claim 1,

further comprising a processing unit, connected to said inputting unit, for converting received data files into processed image data files,

wherein said processing unit is adapted to store a processed image data file in said memory device

and wherein said control unit is adapted to, upon said print command from the operating means, have a processed image data file printed by said printing unit.

5. Apparatus according to claim 4, characterized in that

said control unit is provided with means for inventarising processed image data files stored in the memory device and to present identification data of these image data files via the operating unit to an operator for selection,

and in that the control unit is adapted to have printed on the said print command, a processed image data file stored in the memory device as selected by the operator prior said print command.

6. Apparatus according to claim 3 or 5, wherein said inputting unit is provided with means for extracting identification data from a received data file and is connected to said control unit for transmitting said identification data thereto.

7. Apparatus according to any one of claims 1 or 6, characterised in that an inputting unit comprises a network connection module for connection to a digital network.

8. Apparatus according to any one of claims 1 or 6, characterised in that an inputting unit comprises a device for reading a data storage medium, such as a floppy disk.

9. Apparatus according to any one of the preceding claims, characterised in that it also comprises

a scanning unit for electro-optical scanning of a document and the generation of digital image data in so doing, and

a second processing unit, connected to the scanning unit, for converting the said digital image data into printable image data files,

which second processing unit is also connected to the printing unit for the purpose of delivering printable image data files thereto,

and in that the control unit is also connected to the scanning unit and to the second processing unit, and is provided with means for, on a copying command given via the operating unit, starting the scanning

unit, having the image data generated by the scanning unit converted by the second processing unit into printable image data files, and having the printing unit print the said printable image data files.

10. Apparatus according to any one of claims 3 and 5 to 9, wherein the said means for inventarising and presenting data files stored in the memory device are also adapted to offer an operator the choice of having all the stored data files printed successively.

11. Apparatus according to any one of claims 3 and 5 to 10, wherein the control unit is provided with means for verifying an operator's identification code input by means of the operating means of the operating unit, and

wherein the said means for inventarising and presenting data files stored in the memory device are adapted, at least in respect of predetermined ones of said data files, to present these data files to the operator for selection only after the control unit has verified and approved the said identification code.

12. Apparatus according to any one of the preceding claims, wherein the control unit is adapted automatically to erase from the memory device data files stored therein after expiry of a predetermined period.

13. Apparatus according to any one of the preceding claims, wherein the control unit is adapted, by a command for the purpose from the operating means, to be set to a state in which it causes received data files to be converted and printed without awaiting a print command from the operating means.

Claims:

EP 689157 B1

1. A network printer for connection to a network system including a plurality of workstations, for printing digital print files generated by a document editing application running in a workstation and including a printer driver, said printer comprising

a local operating unit (19) provided with operating means such as a control panel with keys (61-70) and a display (60);

a memory device (23);

an inputting unit (2), including a network connection unit (20), for receiving print files owned by different ones of a plurality of users, from said work stations and storing the same in said memory device (23);

a printing unit (3) for printing print files on image supports; and

a control unit (18), connected to the operating unit (19), the inputting unit (2) and the printing unit (3) for controlling printing print files stored in said memory device (23) by the printing unit; characterized in that

said inputting unit (2) is provided with means (22) for extracting identification data from a received print file and is connected to said control unit (18) for transmitting said identification data thereto,

said control unit (18) is provided with means for inventarising said identification data of received print

files stored in the memory device (23) and to present said identification data, including, for each print file, an identification of the owner, via the operating unit (19) to an operator for selection,

said local operating unit (19) is adapted to report a selection of a print file and a print command, both of them made by an operator using the operating means (19), to the control unit (18), and

said control unit (18) is further adapted to have any print file printed by the printing unit (3) only upon reception of said selection and print command from the operating unit (19).

2. A network printer according to claim 1,

wherein said control unit (19) is adapted to present said identification data of print files, sorted according to the owner.

3. A network printer according to claim 1 or 2,

further comprising a processing unit (24) for converting received print files into printable image data files,

wherein said inputting unit (2) is adapted to store a received print file in said memory device (23)

and wherein said control unit (18) is adapted to, upon said selection and print command from the operating unit (19), have the selected print file converted by said processing unit (24) and have the resulting printable image data file printed by said printing unit (3).

4. A network printer according to claim 1 or 2,

further comprising a processing unit (24), connected to said inputting unit (2), for converting received print files into processed image data files,

wherein said processing unit (24) is adapted to store a processed image data file in said memory device (23),

and wherein said control unit (18) is adapted to, upon said selection and print command from the operating unit (19), have the selected processed image data file printed by said printing unit (3).

5. A network printer according to claim 1,

wherein said inputting unit (2) also includes a device (50) for reading print files out of a data storage medium, such as a floppy disk.

6. A network printer according to claim 1,

wherein said operating unit (19) is also adapted to present printing specifications for selection to an operator and is adapted to report a selection of printing specifications together with said selection of a print file and said print command to the control unit (18),

and wherein the control unit (18) is adapted to have a selected print file printed by the printing unit (3) in accordance with the selected printing specifications.

7. A network printer according to claim 6,

wherein print files received from said external source comprise printing specifications, and

wherein said control unit (18) is adapted to have the operating unit (19) present the printing specifications contained in a print file upon selection of said print file by an operator, so that the latter may change them.

8. A network printer according to any one of the preceding claims, characterised in that it also comprises

a scanning unit (1) for electro-optical scanning of a document and the generation of digital image data in so doing, and

a second processing unit (14), connected to the scanning unit, for converting the said digital image data into printable image data files,

which second processing unit (14) is also connected to the printing unit (3) for the purpose of delivering printable image data files thereto,

and in that the control unit (18) is also connected to the scanning unit (1) and to the second processing unit (14), and is provided with means for, on a copying command given via the operating unit (19), starting the scanning unit, having the image data generated by the scanning unit converted by the second processing unit (14) into printable image data files, and having the printing unit (3) print the said printable image data files.

9. A network printer according to claim 1, wherein the said means for inventarising and presenting data files stored in the memory device (23) are also adapted to offer an operator the choice of having all the stored print files printed successively.

10. A network printer according to claim 1, wherein the control unit (18) is provided with means for verifying an operator's identification code input by means of the operating means of the operating unit (19), and

wherein the said means for inventarising and presenting print files stored in the memory device (23) are adapted, at least in respect of predetermined ones of said print files, to present these print files to the operator for selection only after the control unit has verified and approved the said identification code.

11. A network printer according to any one of the preceding claims, wherein the control unit (18) is adapted automatically to erase from the memory device (23) print files stored therein after expiry of a predetermined period.

12. A network printer according to any one of the preceding claims, wherein the control unit (18) is adapted, by a command for the purpose from the operating means (19), to be set to a state in which it causes received print files to be converted and printed without awaiting a print command from the operating means (19).

Claims:

EP 689157 B1

1. Netzwerkdrucker für den Anschluss an ein Netzwerksystem, das mehrere Workstations enthalt, zum Drucken digitaler Druckdateien, die von einer Dokumentverarbeitungsanwendung erzeugt werden, die in einer Workstation lauft und einem Druckertreiber einschliest, welcher Drucker aufweist:

eine lokale Bedienungseinheit (19) mit Bedienungseinrichtungen wie etwa einer Bedienungstafel mit Tasten (61-70) und einem Display (60);

eine Speichereinrichtung (23);

eine Eingabeeinheit (2) einschlieslich einer Netzwerk-Anschlusseinheit (20) zum Empfang von verschiedenen Benutzern aus einer Vielzahl von Benutzern gehorenden Druckdateien, von den Workstations und zum Speichern derselben in der Speichereinrichtung (23);

eine Druckereinheit (3) zum Drucken von Druckdateien auf Bildtrager und

eine Steuereinheit (18), die mit der Bedienungseinheit (19), der Eingabeeinheit (2) und der Druckeinheit (3) verbunden ist, um das Drucken von in der Speichereinheit (23) gespeicherten Dateien durch die Druckereinheit zu steuern, dadurch gekennzeichnet, dass

die Eingabeeinrichtung (2) eine Einrichtung (22) zum Extrahieren von Identifizierungsdaten aus einer empfangenen Druckdatei aufweist und mit der Steuereinheit (18) verbunden ist, um diese Identifizierungsdaten an sie zu ubermitteln,

die Steuereinheit (18) eine Einrichtung aufweist zum Inventarisieren der Identifizierungsdaten von empfangenen Druckdateien, die in der Speichereinrichtung (23) gespeichert sind, und zum Prasentieren dieser Identifizierungsdaten, einschlieslich, fur jede Druckdatei, einer Identifizierung des Eigentumers, uber die Bedienungseinheit (19) zur Auswahl durch einen Operator,

die lokale Bedienungseinheit (19) dazu ausgebildet ist, eine Auswahl einer Druckdatei und einen Druckbefehl, die beide von einem Operator mit Hilfe der Bedienungseinrichtung (19) gegeben werden, an die Steuereinheit (18) zu melden, und

die Steuereinheit (18) weiter dazu ausgebildet ist, eine Druckdatei nur bei Empfang dieser Auswahl und des Druckbefehls von der Bedienungseinheit (19) durch die Druckereinheit (3) drucken zu lassen.

2. Netzwerkdrucker nach Anspruch 1, bei dem die Steuereinheit (19) dazu ausgebildet ist, die Identifizierungsdaten von Druckdateien nach Eigentumern sortiert zu prasentieren.

3. Netzwerkdrucker nach Anspruch 1 oder 2,

mit einer Verarbeitungseinheit (24) zum Konvertieren von empfangenen Druckdateien in druckbare Bilddateien,

wobei die Eingabeeinheit (2) dazu ausgebildet ist, eine empfangene Druckdatei in der Speichereinrichtung (23) zu speichern,

und wobei die Steuereinheit (8)dazu ausgebildet ist, auf die Auswahl und den Druckbefehl von der Bedienungseinheit (19) hin die ausgewahlte Druckdatei von der Verarbeitungseinheit (24) konvertieren zu lassen und die resultierende druckbare Bilddatei von der Druckereinheit (3) drucken zu lassen.

4. Netzwerkdrucker nach Anspruch 1 oder 2,

mit einer Verarbeitungseinheit (24), die mit der Eingabeeinheit (2) verbunden ist, um empfangene Druckdateien in verarbeitete Bilddateien umzuwandeln,

wobei die Verarbeitungseinheit (24) dazu ausgebildet ist, eine verarbeitete Bilddatei in der Speichereinrichtung (23) zu speichern,

und wobei die Steuereinheit (18) dazu ausgebildet ist, auf die Auswahl und den Druckbefehl von der Bedienungseinheit (19) hin die ausgewahlte verarbeitete Bilddatei von der Druckereinheit (3) drucken zu lassen.

5. Netzwerkdrucker nach Anspruch 1, bei dem die Eingabeeinheit (2) auch eine Einrichtung (50) aufweist, zum Lesen von Druckdateien von einem Datenspeichermedium wie etwa einer Floppy Disk.

6. Netzwerkdrucker nach Anspruch 1,

bei dem die Bedienungseinheit (19) dazu ausgebildet ist, Druckspezifikationen zur Auswahl durch einen Operator zu prasentieren, und dazu ausgebildet ist, eine Auswahl von Druckspezifikationen zusammen mit der Auswahl einer Druckdatei und dem Druckbefehl an die Steuereinheit (18) zu melden,

und wobei die Steuereinheit (18) dazu ausgebildet ist, eine ausgewahlte Druckdatei von der Druckereinheit (3) in Ubereinstimmung mit den ausgewahlten Druckspezifikationen drucken zu lassen.

7. Netzwerkdrucker nach Anspruch 6, bei dem die von der externen Quelle empfangenen Druckdateien Druckspezifikationen enthalten und

die Steuereinheit (18) dazu ausgebildet ist, bei Auswahl der Druckdatei durch einen Operator die in dieser Druckdatei enthaltenen Druckspezifikationen durch die Bedienungseinheit (19) prasentieren zu lassen, so dass sie von dem Operator geandert werden konnen.

8. Netzwerkdrucker nach einem der vorstehenden Anspruche,

dadurch gekennzeichnet, dass er auserdem aufweist:

eine Abtasteinheit (1) zum elektro-optischen Abtasten eines Dokuments und damit zur Erzeugung von digitalen Bilddaten und

eine zweite Verarbeitungseinheit (14), die mit der Abtasteinheit verbunden ist, zum Konvertieren der digitalen Bilddaten in druckbare Bilddateien,

wobei die zweite Verarbeitungseinheit (14) auch mit der Druckereinheit (3) verbunden ist, damit sie die druckbaren Bilddateien an diese ausgeben kann,

und dass die Steuereinheit (18) auch mit der Abtasteinheit (1) und der zweiten Verarbeitungseinheit (14) verbunden ist und eine Einrichtung aufweist, um auf einen uber die Bedienungseinheit (19) eingegebenen Kopierbefehl hin die Abtasteinheit zu starten, die von der Abtasteinheit erzeugten Bilddaten durch die zweite Verarbeitungseinheit (14) in druckbare Bilddateien umwandeln zu lassen und die druckbaren Bilddateien durch die Druckereinheit (3) drucken zu lassen.

9. Netzwerkdrucker nach Anspruch 1, bei dem die Einrichtung zum Inventarisieren und Prasentieren von in der Speichereinrichtung (23) gespeicherten Dateien auch dazu ausgebildet ist, einen Operator die Wahl anzubieten, samtliche gespeicherten Druckdateien nacheinander drucken zu lassen.

10. Netzwerkdrucker nach Anspruch 1, bei dem die Steuereinheit (18) eine Einrichtung zum Verifizieren eines mit Hilfe der Bedienungseinrichtungen der Bedienungseinheit (19) eingegebenen Identifizierungscodes eines Operators aufweist und bei dem die Einrichtung zum Inventarisieren und Prasentieren von in der Speichereinrichtung (23) gespeicherten Druckdateien dazu ausgebildet ist, zumindest in Bezug auf vorbestimmte der Druckdateien, diese Druckdateien dem Operator erst dann zur Auswahl zu prasentieren, wenn die Steuereinheit den Identifizierungscode verifiziert und bestatigt hat.

11. Netzwerkdrucker nach einem der vorstehenden Anspruche, bei dem die Steuereinheit (18) dazu ausgebildet ist, Druckdateien, die in der Speichereinrichtung (23) gespeichert sind, nach Ablauf einer vorgegebenen Zeitspanne automatisch aus der Speichereinrichtung zu loschen.

12. Netzwerkdrucker nach einem der vorstehenden Anspruche, bei dem die Steuereinheit (18) dazu ausgebildet ist, durch einen entsprechenden Befehl von der Bedienungseinrichtung (19) in einen Zustand versetzt zu werden, in dem sie die Umwandlung und das Drucken von empfangenen Druckdateien veranlasst, ohne einen Druckbefehl von der Bedienungseinrichtung (19) abzuwarten.

Claims:

EP 689157 B1

1. Imprimante de reseau destinee a etre raccordee a un systeme de reseau incluant une pluralite de postes de travail, pour l'impression de fichiers d'impression numeriques produits par une application d'edition de documents se deroulant dans un poste de travail et incluant un etage de commande d'imprimante, ladite imprimante comprenant

une unite locale de fonctionnement (19) pourvue de moyens de fonctionnement tels qu'un panneau de commande comportant des touches (61-70) et un dispositif d'affichage (60);

un dispositif de memoire (23);

une unite d'entree (2), incluant une unite (20) de connexion au reseau, pour recevoir des fichiers d'impression possedes par differents utilisateurs parmi une pluralite d'utilisateurs, a partir desdits postes de travail et memoriser ces fichiers dans ledit dispositif de memoire (23);

une unite d'impression (3) pour imprimer des fichiers d'impression sur des supports d'images; et

une unite de commande (18), connectee a l'unite de fonctionnement (19), l'unite d'entree (2) et l'unite d'impression (3) servant a commander l'impression de fichiers d'impression memorises dans ledit dispositif de memoire (23) par l'unite d'impression; caracterisee en ce que

ladite unite d'entree (2) est pourvue de moyens (22) pour extraire des donnees d'identification provenant d'un fichier d'impression recu et est connectee a ladite unite de commande (18) pour la transmission desdites donnees d'identification a cette unite,

ladite unite de commande (18) est equipee de moyens pour faire l'inventaire desdites donnees d'identification de fichiers d'impression recus memorises dans le dispositif de memoire (23) et presenter

lesdites donnees d'identification, incluant pour chaque fichier d'impression, une identification du possesseur, par l'intermediaire de l'unite de fonctionnement (19) a l'operateur a des fins de selection,

ladite unite locale de fonctionnement (19) etant adaptee pour signaler a l'unite de commande (18) une selection d'un fichier d'impression et une commande d'impression, toutes les deux etant realisees par un operateur utilisant les moyens de fonctionnement (19), et

ladite unite de commande (18) est en outre adaptee pour faire imprimer n'importe quel fichier d'impression par l'unite d'impression (3) uniquement a la reception de ladite selection et de ladite commande d'impression en provenance de l'unite de fonctionnement (19).

2. Imprimante de reseau selon la revendication 1, dans laquelle ladite unite de commande (19) est adaptee pour presenter lesdites donnees d'identification de fichiers d'impression, tries en fonction du possesseur.

3. Imprimante de reseau selon la revendication 1 ou 2, comprenant en outre une unite de traitement (24) pour convertir des fichiers d'impression recus en des fichiers de donnees d'images imprimables,

dans laquelle ladite unite d'entree (2) est adaptee pour memoriser un fichier d'impression recu dans ledit dispositif de memoire (23), et

dans laquelle ladite unite de commande (18) est adaptee pour, lors de ladite selection et de ladite commande d'impression a partir de l'unite de fonctionnement (19), faire convertir le fichier d'impression selectionne par ladite unite de traitement (24) et faire imprimer le fichier de donnees d'images imprimables resultant, par ladite unite d'impression (3).

4. Imprimante de reseau selon la revendication 1 ou 2,

comprenant en outre une unite de traitement (24) connectee a ladite unite d'entree (2), pour convertir des fichiers d'impression recus en des fichiers de donnees d'images traitees,

dans laquelle ladite unite de traitement (24) est adaptee pour memoriser un fichier de donnees d'images traitees dans ledit dispositif de memoire (23), et

dans laquelle ladite unite de commande (18) est adaptee pour, lors de ladite selection et de ladite commande d'impression provenant de l'unite de fonctionnement (19), faire imprimer le fichier de donnees d'images traitees selectionne par ladite unite d'impression (3).

5. Imprimante de reseau selon la revendication 1, dans laquelle ladite unite d'entree (2) inclut egalement un dispositif (50) pour lire des fichiers d'impression dans un support de memorisation de donnees, tel qu'une disquette.

6. Imprimante de reseau selon la revendication 1,

dans laquelle ladite unite de fonctionnement (19) est egalement adaptee pour presenter a un operateur des specifications d'impression pour la selection et est adaptee pour signaler a l'unite de commande (18) une selection de specifications d'impression conjointement avec ladite selection d'un fichier d'impression et de ladite commande d'impression, et

dans laquelle l'unite de commande (18) est adaptee pour faire imprimer le fichier d'impression

selectionne par l'unite d'impression (3) conformement aux specifications d'impression selectionnees.

7. Imprimante de reseau selon la revendication 6,

dans laquelle des fichiers d'impression recus provenant de ladite source externe comprennent des specifications d'impression, et

dans laquelle ladite unite de commande (18) est adaptee pour amener l'unite de fonctionnement (19) a presenter les specifications d'impression contenues dans un fichier lors de la selection dudit fichier d'impression par un operateur, de sorte que ce dernier peut modifier les specification.

8. Imprimante de reseau selon l'une quelconque des revendications precedentes, caracterisee en ce qu'elle comprend egalement

une unite d'exploration par balayage (1) pour realiser le balayage electro-optique d'un document et la production de donnees d'images numeriques lors de cette operation, et

une seconde unite de traitement (14) connectee a l'unite d'exploration par balayage pour convertir lesdites donnees d'images numeriques en des fichiers de donnees d'images imprimables,

laquelle seconde unite de traitement (14) est egalement connectee a l'unite d'impression (3) pour delivrer des fichiers de donnees d'images imprimables a cette unite d'impression, et

que l'unite de commande (18) est egalement connectee a l'unite d'exploration par balayage (1) et a la seconde unite de traitement (14) et est pourvue de moyens permettant, lors d'une commande de copie delivree par l'intermediaire de l'unite de fonctionnement (19), faire demarrer l'unite d'exploration par balayage, provoquer la conversion des donnees d'images produites par l'unite d'exploration par balayage, par la seconde unite de traitement (14) en des fichiers de donnees d'images imprimables, et pour provoquer l'impression desdits fichiers de donnees d'images imprimables par l'unite d'impression (3).

9. Imprimante de reseau selon la revendication 1, dans laquelle lesdits moyens de creation d'inventaire et de presentation de fichiers de donnees memorises dans le dispositif de memoire (23) sont egalement adaptes pour fournir a l'operateur le choix de disposer de tous les fichiers d'impression memorises, imprimes successivement.

10. Imprimante de reseau selon la revendication 1, dans laquelle l'unite de commande (18) est pourvue de moyens pour verifier un code d'identification d'operateur introduit par les moyens de fonctionnement de l'unite de fonctionnement (19), et

dans laquelle lesdits moyens de realisation d'inventaire et de presentation de fichiers d'impression memorises dans le dispositif de memoire (23) sont adaptes pour presenter, au moins en rapport avec certains predetermines desdits fichiers d'impression, ces fichiers d'impression a l'operateur pour une selection, uniquement apres que l'unite de commande a verifie et approuve ledit code d'identification.

11. Imprimante de reseau selon l'une quelconque des revendications precedentes, dans laquelle l'unite de commande (18) est adaptee pour effacer automatiquement, du dispositif de memoire (23), des fichiers d'impression memorises dans ce dispositif, apres l'expiration d'un intervalle de temps predetermine.

12. Imprimante de reseau selon l'une quelconque des revendications precedentes, dans laquelle l'unite de commande (18) est adaptee pour etre placee, au moyen d'une commande effectuee dans ce but a partir

des moyens de fonctionnement (19), dans un etat dans lequel elle provoque la conversion de fichiers d'impression recus et leur impression sans attendre une commande d'impression provenant des moyens de fonctionnement (19).

European Patents Fulltext
Dialog® File Number 348 Accession Number 729780

ᴘᴏᴡᴇʀᴇᴅ ʙʏ **Dialog**

Method of trapping graphical objects in a desktop publishing program.
Verfahren zum Einfuhren von graphischen Objekten in einem Desk-Top-Publishing-Programm.
Methode de capture d'objets graphiques dans un programme de publication par ordinateur.

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Patent

Country Code/Number	Kind	Date
EP 674277	A2	September 27, 1995 (Basic)
EP 674277	A3	March 26, 1997

Application

Country Code/Number	Date
EP 95301898	March 22, 1995

Priority Application Number (Country Code, Number, Date): US 216729 (940323)
Designated States: CH; DE; FR; GB; IT; LI
International Patent Class: G06F-017/21; G06K-015/12; H04N-001/58

Abstract: EP 674277 A2

Disclosed is a method of trapping a publication specified in a PostScript page description language
(PDL) or other PDL file by modifying the publication prolog to create traps within an interpreter or RIP.
(see image in original document)

Legal Status

Type	Pub Date	Kind	Description
Withdrawal:	010321	A2	Date application deemed withdrawn: 20001003
Application:	950927	A2	Published application (A1 with Search Report;A2 without Search Report)
*Assignee:	960207	A2	Applicant (transfer of rights) (change): ADOBE SYSTEMS INC. (1120810) 1585 Charleston Road Mountain View California 94039-7900 (US) (applicant designated states: CH;DE;FR;GB;IT;LI)
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Search Report:	970326	A3	Separate publication of the European or International search report
Change:	970326	A2	Obligatory supplementary classification (change)
Examination:	971119	A2	Date of filing of request for examination: 970918
Examination:	990127	A2	Date of despatch of first examination report: 981214

Language (Publication, Procedural, Application): English; English; English

Specification:

EP 674277 A2

Cross-Reference to Related Applications

This application is related to U.S. Patent Application Serial No. 08/188,246, filed January 26, 1994, entitled "Applying Traps to a Printed Page Specified in a Page Description Language Format" and assigned to the assignee of the present invention. United States Patent Application Serial No. 08/188,246 is hereby incorporated by reference.
Field of the Invention

The invention generally relates to color trapping and, more particularly, to a method of creating traps for objects in desktop publishing programs.
Background of the Invention

Color printing has traditionally required the integration of many unique and varied talents to see a project through from conception to a printed page. Prior to "desktop publishing," ideas or concepts were typically first drawn by hand and photographed, any text or illustrations added, and the aggregate of pictures and text used to produce a printed page. The traditional process generally required, in addition to design personnel, a paste-up person, typesetting bureau and a lithography department that would produce separations from the photographs.

Desktop publishing has relieved some of the burden of publishers by allowing color production, i.e., drawing and layout, to be integrated electronically using personal computers. Color documents can now be designed, enhanced, color-corrected, and separated on a computer "desktop." The success of desktop publishing is, in large part, the result of standards-based computer programs such as the page description language (PDL) PostScript(R) from Adobe Systems Incorporated of Mountain View, California. The PostScript language has become the industry standard that serves as an intermediary between

applications packages, e.g., desktop publishing programs, and PDL-compatible composite reproduction equipment, such as a desktop printer. The applications packages translate information for a page into PDL for transmission to the PDL-compatible desktop printer. The PDL-compatible printer includes an interpreter that converts the PDL code to low-level instructions that indicate to the printer how to render the text and graphics. Alternatively, the information can be transferred to a file for importation by another applications program or for use by a service bureau. The process of interpreting and rendering PDL is often performed within a raster image processor or "RIP." For further information on the PostScript programming language, please see PostScript Language Reference Manual, 2nd Ed., by Adobe Systems, Inc., published by Addison Wesley, which is hereby incorporated by reference.

A desktop printer uses toner to produce the colors comprising a color publication. Because composite printing is generally efficient only for small quantity jobs, larger quantities of the same publication are generally reproduced on a commercial printing press using ink. Methods of printing color publications using a commercial printer press include process-color printing, spot-color printing, or a combination of the two. Process-color printing separates the original image into its cyan (C), magenta (M), yellow (Y), and black (K) components to recreate the original shadings of color in the publication. This is accomplished by printing dots of the process-color inks in different combinations in close proximity to simulate a variety of colors on a printed page. Spot-color printing involves printing one or more specific colors (or inks) that have been specified according to a color matching system. One popular color matching system is the PANTONE(TM) MATCHING SYSTEM by Pantone, Inc. Spot-color printing is often used to produce colors that are not easily produced using CMYK inks, such as silver, gold, and fluorescent colors. Spot-color printing is also used in lieu of printing the four process colors, such as when only a couple of inks are required for a particular publication.

Before a color publication can be reproduced on a commercial printing press, each page containing composite art must be separated into its component colors by printing a film separation for each ink (cyan, magenta, yellow, and black, if process colors are to be printed) and any spot colors. Thus, process-color printing always requires four film separations. Spot-color printing requires a separation for each color being printed. A commercial printer uses these film separations to create the printing plates used on the press. For instance, if one specifies the four process colors and a single spot color in a publication, there will be five separations, and hence printing plates, for each page. A separate component ink is added by each plate as the pages in the publication pass through the press. For a more detailed explanation of the commercial printing process, please see the Commercial Printing Guide from PageMaker(R), Version 5.0. PageMaker(R) is a desktop publishing program produced by Aldus Corporation, the assignee of the present application. The PageMaker 5.0 User Manual and Commercial Printing Guide are hereby incorporated by reference. For additional information on desktop publishing generally, see Desktop Publishing in Color by Michael Kieran, published by Bantam Books (1991), which is also incorporated by reference.

High-quality printing, such as that required by the publishing industry, poses many difficult problems in controlling the separations. For example, color printing is compromised if paper is not properly aligned as it makes multiple passes through the plates of a printer. This problem is typically referred to as misregistration. One common solution to the registration problem is to perform a technique known as trapping. Trapping refers to expanding or "spreading" regions of a particular color beyond its normal boundaries, and contracting or "choking" a color region so that a small overlap exists between graphical objects where misregistration may occur. Trapping techniques have traditionally been performed manually. Although tedious, in the past, manual trapping techniques have been used in applications such as magazine publishing, where the time and labor required to create individual traps for each printed page are economically justified.

In recent years, computer systems that perform choking and spreading electronically have come into widespread use. A typical approach has been to: (I) start with a PDL file such as a PostScript file; (2) convert the vector graphics and/or text within the PDL file into a raster (bit mapped) image through a RIP; and (3) trap the raster image using pixel data comprising the image. The third step usually requires a creation of a separate frame buffer for each of the process colors. Each frame buffer is then choked and spread on a pixel-by-pixel basis, and the result used to control the printing of its respective color. As will be appreciated, this approach is very memory intensive.

A more recent approach to electronic trapping is set forth in U.S. Patent No. 5,295,236 ("'236 patent"), titled "Applying Traps to a Printed Page Specified in a Page Description Language Format" and assigned to the assignee of the present invention. The '236 patent discloses a method and apparatus for electronically trapping a printed color page in a desktop publishing, layout, graphics, or similar applications program. The method translates PDL instructions comprising the printed page into a format suitable for detection and analysis of edges between color regions in the printed page; creates, according to a set of trapping rules, a set of traps between the color edges; and produces a trap output file that includes the traps expressed in the PDL format. Such a method is referred to as a "post-processing approach." An advantage to the method described in the '236 patent is that virtually any printed page that is expressed in a PDL format may be trapped regardless of the application that originally created the graphics, i.e., the originating program. However, this capability is at the expense of software complexity. In particular, the PDL file must be interpreted before traps are created.

Another approach to electronic trapping is to have the originating program also create traps for the graphics. As an example, in drawing programs such as Aldus Freehand(R), a user is allowed to add outlines around objects to accommodate trapping. Trapping approaches at the originating program level are beneficial because additional trapping costs may be eliminated, i.e., it is not necessary to utilize a post-processing program or traditional trapping techniques. However, the capability to perform trapping in originating programs is relatively new, and has typically required extensive reworking of the computer code comprising the programs. This, in turn, requires a new release of the software, and involves associated costs with such a release, including extensive debugging. Further, trapping capabilities in originating programs have typically been very limited. One shortcoming is apparent in situations where the background and/or foreground is formed by a number of differently colored objects. This situation arises, for example, where individual text characters overlap more than one object. Typical originating programs with trapping capabilities tend to handle objects such as text or boxes in a relatively course fashion, such that traps are only able to be applied to an entire text block, or at best an entire character. Thus, the trap results in these instances are less than desirable.

In contrast to the prior art discussed above, the invention alleviates the need to change the computer code of the originating application to provide trapping capabilities and reimplement the PDL interpreter. Hence, a trapping method implemented in accordance with the invention may be created, debugged, and distributed independent of the desktop publishing program. Further, as will be described in detail below, the invention allows very accurate trap placement, thus providing results superior to trapping solutions currently availabie in originating programs.
Summary of the Invention

The invention is a method of electronically trapping a printed page that includes a plurality of objects expressed in a page description language, with the page description language instructions being interpreted by a raster image processor for output to an output device. The method comprises the step of providing instructions to the raster image processor to trap the objects in the page as the page description language instructions comprising the objects are interpreted by the raster image processor.

In accordance with other aspects of the invention, the printed page is in a publication in a desktop publishing program. The publication including a prolog and a script that specify the objects to be printed. The method further includes the step of modifying the publication prolog to provide the trapping instructions to the raster image processor. Further, the script is sent unmodified to the raster image processor.

In accordance with still further aspects of the invention, the printed page is in a publication in a desktop publishing program. The method comprises the steps of: (a) modifying the publication prolog to instruct the raster image processor to (i) create a directory of the color objects in the publication and (ii) trap the color objects in the publication using the shape directory; and (b) sending the modified publication prolog and script to the raster image processor wherein trap areas are created as the publication is rendered.

Brief Description of the Drawings

The above and further advantages of the invention may be better understood by referring to the following description together with the accompanying drawings, wherein:

FIGURE 1 is a block diagram of a trapping program in accordance with the invention that works in conjunction with prior art desktop publishing programs to trap a publication as it is being rasterized by a raster image processor (RIP);

FIGURE 2 is a block diagram illustrating a PDL publication, including a prolog and script, being sent to a RIP by a desktop publishing program in accordance with conventional procedure;

FIGURE 3 is a flow chart illustrating a conventional procedure by which a desktop publishing program sends information to a RIP enabling it to draw a publication;

FIGURE 4 is a flow chart illustrating the internal procedure followed by a conventional RIP to draw an object in a PDL publication;

FIGURE 5 is the block diagram of FIGURE 2 but including revisions that illustrate the sending of additional prolog commands to the RIP to facilitate trapping of the publication in accordance with the invention;

FIGURE 6 is a flow chart of an exemplary routine by which a desktop publishing program sends information to a RIP enabling it to trap a publication in accordance with the invention;

FIGURE 7 is a flow chart of an exemplary routine illustrating how traps are created for objects by the RIP in accordance with the invention;

FIGURE 8 is a flow chart illustrating how objects are trapped within the RIP in accordance with the invention, as a result of the instructions created and sent to the RIP in FIGURE 6;

FIGURE 9 is a flow chart of an exemplary routine in accordance with the invention for revising a trap created for a background object when multiple overlaps interfere with the trap;

FIGURE 10 is a block diagram of a simplified PDL, e.g., PostScript, publication, including a prolog and script written in pseudo code;

FIGURE 11 is a block diagram of the PDL publication illustrated in FIGURE 10, but including

modifications to the prolog to provide trapping of the publication during the rendering process at the RIP;

FIGURES 12A-12C illustrate a trapping example involving exemplary objects X and Y to facilitate explanation of the invention;

FIGURES 13A-13C illustrate the trapping example of FIGURES 12A-12C but including a third object Z that overlaps the original objects; and

FIGURES 14A-14C illustrate the repairing of a previous trap in accordance with the procedure set forth in FIGURE 9.

Detailed Description of the Preferred Embodiment

A trapping program 20 in accordance with the invention is illustrated in FIGURE 1. The trapping program 20 works in conjunction with a computer program, such as a desktop publishing program 22, that is suitable for incorporating text, graphics and other aspects of documents to be published. The desktop publishing program 20 may be, for example, the PageMaker(R) desktop publishing program sold and supported by Aldus Corporation, the assignee of the present invention. It is noted, however, that the benefits of the invention are not limited to use with an application whose primary purpose is to combine text and graphics. Thus, throughout the specification and claims, the term "desktop publishing program" is hereby defined as any computer program that has the ability to manipulate graphical objects, including programs such as presentation, art, and drawing programs.

The trapping and desktop publishing programs 20 and 22 run on a processing unit 24 controlled by an operating system 26. Memory 28 is connected to the processing unit and generally comprises, for example, random access memory (RAM), read only memory (ROM), and magnetic storage media such as a hard drive, floppy disk, or magnetic tape. The processing unit and memory are typically housed within a personal computer 30, including Macintosh(TM), International Business Machines (IBM(TM)), and IBM-compatible personal computers. When used with IBM and IBM-compatible personal computers, the operating system 26 may incorporate a windowing environment such as Microsoft Windows(TM).

The desktop publishing program 22 includes a user interface 32 that interacts between the operating system 26 and the internal process application of the desktop publishing program 22. Using the desktop publishing program 22, an author creates the text, images, and graphics comprising a publication. Text, images and graphics are generically referred to as "objects" through the specification and claims. In many cases, the data comprising a publication is also imported from one or more sources including, for example, illustration, image enhancement, word processing, and desktop publishing programs. At block 34, input data including text 36 and graphics 38 that were created within or imported into a publication are shown. After the input data comprising a publication have been entered, the data may be trapped using the trapping program 20. As will be apparent from the following discussion, this is accomplished by sending instructions to a PostScript (PS) interpreter or raster image processor (RIP) 40, e.g., within a printer or at a service provider, to trap the objects in the publication as the PS instructions comprising the publication are being interpreted. The RIP 40 then outputs the data comprising the trapped publication to film or paper.

Prior to discussing the specific details of how trapping is accomplished by the trapping program 20, background information on the operation of PDL languages, and directed specifically toward the PS language, is provided. While the remainder of this discussion focuses on the PS language, those skilled in the art will appreciate that the ideas presented are applicable to other page description languages as

well.

With reference to FIGURE 2, the recommended structure for a PDL file such as a PS publication 50 file is that it contain two basic components: a prolog 52 and a script 54. The prolog 52 contains routines or procedures, as well as named variables and constants, that will be used throughout the rest of a publication. As is known by those skilled in the art, it is efficient to have a routine to perform a given task that will be repeated multiple times, e.g., drawing a line, box, or oval, and then call the routine with the appropriate parameters. In contrast, a more burdensome approach would be to set forth all of the instructions contained in the routine each time a line, box, or oval is to be drawn. The prolog is written by a PDL programmer, and will precede the first part of every publication, or script, that uses it. The script 54 provides the setup for the publication and describes the specific elements to be produced as the output in terms of procedures and variables defined in the prolog, along with operand data.

When a user of the desktop publishing program enters the print command, the prolog 52 and script 54 are sent to the RIP 40 where the PDL language is interpreted and converted into a bit map format. The bit map is used to draw the objects in the publication on paper or film.

FIGURE 3 is a flow diagram of a prior art routine that illustrates the construction of a publication written in PS language at the interpreter/RIP level. At block 100, the prolog from the publication is sent to the RIP. The next (current) page to be printed is then targeted for "printing" at block 110. Printing in this context refers to sending the PS commands to a RIP, and not necessarily the act of placing ink on paper. At block 112, a test is made to determine whether all objects in the current page have been printed. If all objects in the current page have not been printed, the next object to be considered is selected at block 114. At block 116, the appropriate PS commands are constructed to create the object. The PS commands are then sent to the RIP at block 118, and the routine loops to block 112.

If all the objects in the current page were determined to be printed at block 112, a test is made at block 120 to determine if all pages in the publication have been printed. If all pages in the publication have not been printed, the routine loops to block 110. Otherwise, the routine is terminated and the RIP is ready to begin converting the PS code comprising the publication into a format acceptable to an output device such as an imagesetter (creating film) or a printer. FIGURE 4 illustrates a simplified, generic version of the process that occurs at the RIP for any given object to be printed. More particularly, at block 122 the parameters for the object are accepted. These were created and sent to the RIP by blocks 116 and 118 of FIGURE 3. The object is then drawn using the parameters, as indicated at block 124. The routine then terminates.

The flow diagram of FIGURE 4 illustrates precisely what PostScript was intended to do: Indicate to an interpreter/RIP objects to be printed and then have the commands carried through. In other words, the function of the RIP has traditionally been to simply draw objects in a publication in accordance with the PDL commands sent to it. In contrast, the invention extends the function of the RIP beyond traditional concepts by instructing the RIP to create traps for objects at the interpretation/rasterization level. FIGURE 5 illustrates this concept pictorially. The procedure is similar to FIGURE 2, but includes the following new steps. First, prolog commands 122 that instruct the RIP to trap objects in the publication 50 are created by the trapping program 20 and forwarded to the RIP, along with the traditional prolog commands and the script comprising a publication. More specifically, the prolog 54 is substituted with a trapping prolog 124. It is noted that the script itself does not change, and thus this portion of the code within the desktop publishing program 22 need not be modified.

At this point, all control of the publication is at the RIP 40. The RIP interprets the PS instructions in the trap prolog 124, which indicate that a listing, referred to as the "shape directory" 126, is to be created of

the objects in the publication as the objects are drawn. Additional PS instructions in the trap prolog 124 indicate that the objects in the publication, including text and graphics, are to be trapped using the shape directory, with the objects and resultant traps being rasterized and sent to an output device by the RIP.

FIGURE 6 illustrates an exemplary routine for implementing the trapping program 20 in conjunction with a desktop publishing program. At block 130, a test is made to determine whether a user wishes to trap a publication in the desktop publishing program. In one embodiment, the user will indicate that a publication is to be trapped prior to invoking the "print" command. If the current publication is to be trapped, at block 132 the preamble normally associated with the publication is replaced with a trap prolog. It will be apparent to those skilled in the art how to facilitate substitution of the normal prolog with the trap prolog for the desktop publishing program of interest.. For example, in the Macintosh(TM) version of the PageMaker 5.0 program, the prolog used for a given publication will typically be the one that was most recently opened in the current session. Thus, the trapping program will ensure that the trap prolog is referenced if trapping is desired, and not otherwise. As an alternative to this scheme, the PageMaker 5.0 program will look for a particular file that, if it contains a prolog, will override earlier versions of the prolog. This option may be used in lieu of the one described above. Similarly, other desktop publishing programs have methods of accomplishing the substitution.

After the prologs have been substituted, the trap prolog is sent to the RIP at block 100. If the publication is not to be trapped, the routine skips the prolog replacement step at block 132, and loops to block 100 where the normal prolog is sent to the RIP. Blocks 110-120 have identical functions as those shown and discussed relative to FIGURE 3.

FIGURE 7 illustrates the steps performed by the RIP in printing an object after receiving the trap prolog from the trapping program 20 and the script from the desktop publishing program 22. At block 170, the parameters from the script are accepted for an object to be printed, termed the "current object." At block 172, the object is drawn using these parameters. The object is added to a shape directory at block 174. In a preferred embodiment, only graphical objects are stored in the shape directory, although it may be advantageous to include text in the listing in certain applications. A test is made at block 176 to determine if there are any additional objects in the shape directory. If there are objects in the shape directory, the current object is trapped against those objects, as indicated at block 178. Once the current object has been trapped, or if there were no additional objects in the shape directory, the routine terminates.

FIGURE 8 is a routine suitable for use in FIGURE 7 for trapping the current object being printed in a publication. At block 180, an object from the shape directory is retrieved. The most recently retrieved object from the shape directory is referred to as the "background object" throughout the flow diagram and this discussion. In a preferred embodiment, the objects in the shape directory are retrieved on a first-in, first-out basis, with the bottom-most objects being among the first to be added to the shape directory, and the top-most object being last. Those skilled in the art will appreciate that this bottom-to-top scheme is a direct result of the intricacies of how PostScript handles objects and clipping of objects internally. Other page description languages, or future versions of PostScript, might support a top-to-bottom or hybrid approach, if this is desirable. In this sense, the particular retrieval order is not germane to the invention.

At block 182, a test is made to determine whether the current object overlaps the background object. As will be appreciated by those skilled in the art, if the current object does not overlap the background object, there is no need to create a trap between these objects. If the current object overlaps the background object, a clipping path is set to the outline of the background object at block 184. The effect of setting the clipping path will be for the RIP to ignore everything on the page except for the

background object and any object that overlaps the background object. At block 186, a subroutine Repair Trap is called. This routine will remove parts of unwanted traps that were added but are not ideal solutions because of multiple overlapping objects, as discussed further below.

At block 188, a test is made to determine if the current object is to be trapped and, if so, the color and placement of the trap are set at block 190. The trap is then drawn according to the color and placement determinations, shown at block 192. Once the trap for the current object is drawn at block 192, or if it was determined that the current object was not to be trapped, or if the current object did not overlap or abut the trapped object as determined at block 182, a test is made at block 194 to determine whether any background objects that have yet to be considered in the shape directory. If there are objects remaining, the routine loops to block 180 where the next background object is retrieved from the shape directory. Otherwise, the routine terminates and control is returned to block 176 of FIGURE 7.

The decision of whether or not a trap should be created, as determined at block 188, may be based on a number of different criteria. For example, it may be acceptable to refrain from trapping text below a certain point size, e.g., 24 points. In a preferred embodiment, this is a user-definable variable. Step limits may also be implemented, such that a trap is not created if the relationship of the colors of two intersecting objects is within a given threshold. The threshold may be determined by realizing that the effort expended in trapping certain color intersections outweighs the benefit of the trap. It is noted that it may be more efficient to make at least some of these determinations earlier in the process, as opposed to making them at block 188. For additional criteria in determining whether or not a trap should be created, and for criteria on determining trap placement and color, please refer to U.S. Patent Application Serial No. 08/188,246, entitled "Applying Traps to a Printed Page Specified in a Page Description Language Format," which was already incorporated by reference.

FIGURE 9 is an exemplary subroutine that takes into account errors that may be created using the trapping program 20 when three or more objects overlap one another. A test is made at block 200 to determine whether the current object has been trapped before, i.e., has any trapped edges. If the current object has been trapped before, it is advantageous to remove the prior trap from any edge or portion thereof that intersects the background object. This is because the background object that is currently being considered may overwrite the former background object that caused the trap to be created in the first place. In turn, the former trap may interfere with a trap to be created between the current object and the background object currently being considered, producing spurious results. In other words, if it was determined that the current object has been trapped prior to this pass, and since it is known that the background object under consideration intersects the current object (from block 182 of FIGURE 8), it is preferable to eliminate the earlier trap at the areas in which there is an overlap. Please refer to FIGURES 14A-14C for additional explanation.

The elimination of an earlier-created trap, or portion thereof, may be accomplished by stroking the overlapping or affected edge(s) or portions thereof with the fill color of the background object, as shown in block 202. While this step will remove the previous trap from the background object, it will have the negative effect of drawing the background color onto part of the current object. This result is the phenomenon of the PS language, in that the entire centerline comprising the trap must be redrawn, and the redraw will extend into both the current and background objects.

To eliminate the negative effect of stroking the affected edge, the current object is filled with the current objects' fill color at block 204. Once the current object has been redrawn with its fill color, or if it was determined that there were no traps drawn against the current object at block 200, the subroutine terminates and control is returned to block 186 of FIGURE 8. Thereafter, a trap will be created, if desired, between the current and background objects at their intersecting edge(s).

The remainder of the Detailed Description and accompanying drawings set forth examples that facilitate a more thorough understanding of the invention. FIGURE 10 illustrates a simplified publication 210 having a prolog 212 and a script 214. The prolog 212 includes a single procedure 216 labeled "Rectangle" that may be used for creating rectangles and the like within the publication using the desktop publishing program. The script 214 includes two exemplary calls 218 and 220 to the procedure 216, each causing a rectangle to be drawn of an indicated size, at an appropriate position, and at a necessary rotation, as well as any other variables necessary for drawing the object. When the publication is to be printed, the prolog and script commands are sent to the RIP, which interprets, rasterizes and outputs the resultant bit map to a printer or film. It is noted that the commands shown in FIGURE 10 are in pseudo code, and do not necessarily correspond to actual PS commands.

FIGURE 11 illustrates the modification made to the prolog 212 of FIGURE 10 in order to accommodate trapping in accordance with the invention. Specifically, a trap prolog 222 to accomplish trapping includes the addition of two lines of pseudo code to the original prolog 212. Namely, line 224 stores objects in the shape directory as they are being drawn. As was discussed above, in a preferred embodiment, only the graphical objects are stored, and not text. The second line of code added, line 226, traps the object currently being drawn against all the other objects in the shape directory. Trapping of the object may be accomplished by the routines set forth in FIGURES 7 and 8 and accompanying text. It is noted that FIGURES 10 and 11 are illustrative only, and actual PS commands and subroutine must be inserted in order for the routines to be executable.

FIGURES 12A-12C illustrate a foreground Object Y that is to be trapped against a background Object X. This discussion begins with the routine of FIGURE 8, and assumes that both Object X and Y were drawn and added to the shape directory using the routine of FIGURE 7. At block 176, there is one additional object in the shape directory (Object X), and the trapping routine of FIGURE 8 is called. Object Y is the "current object" under consideration.

With reference to block 182 of FIGURE 8, since Object Y overlaps Object X (FIGURE 12B), it may need to be trapped. The clipping path is set at block 184 and Repair Trap is called at block 186. Since Object Y has not been trapped before (block 200, FIGURE 9), control returns to block 188 of FIGURE 8. Assuming that Object Y is to be trapped, the trap color and placement are determined at block 190 and a trap 230 is drawn at block 192. As there are no other objects in the shape directory, the process is complete and control returns to the routine of FIGURE 7, which has also been completed.

FIGURES 13A-13C illustrate the addition of a third Object Z to the above example, and further assumes that the routine Repair Trap is not implemented. Beginning with FIGURE 13A, the Object Z is drawn and added to the shape directory using blocks 172 and 174 of FIGURE 7. At block 176, there are additional objects in the shape directory (Objects X and Y), and the trapping routine of FIGURE 8 is called. Object Z is the "current object" under consideration.

With reference to block 182 of FIGURE 8, the background object first considered is Object X, as the objects from the shape directory are retrieved from the bottom up. Since Object Z overlaps Object X, it may need to be trapped against Object X. The clipping path is set at block 184. In this example, it is assumed for illustrative purposes that Repair Trap is not implemented, and thus block 188 is considered. Assuming that Object Z is to be trapped, the trap color and placement are determined at block 190 and a trap 232 is drawn at block 192. An exemplary trap 232 is shown in FIGURE 13B. The trap 232 is a trap resulting from the intersection of Objects X and Z, and Object Y has not yet been taken into account. Once the trap for this intersection is drawn in block 192, a test is made at block 194 to determine if any objects remain in the shape directory that have not been considered. Object Y has yet to be considered,

and the routine loops to block 180 where Object Y is retrieved. Object Y is now the "background object" being compared to the current object, Object Z.

With reference to block 182, since Object Z overlaps Object Y, it may need to be trapped against Object Y. The clipping path is set at block 184. Again, Repair Trap is not called due to the assumption stated above. Assuming that Object Z is to be trapped against Object Y, the trap color and placement are determined at block 190 and a trap 234 is drawn at block 192. Trap 234 is shown in FIGURE 13C. At this point, there are no other objects in the shape directory to be considered, and the process is complete. Thus, control returns to the routine of FIGURE 7, which has also been completed.

As can be seen, the result in FIGURE 13C is less than ideal, because the traps 232 and 234 have combined to form overlapping traps. FIGURES 14A-14C illustrate the effects of the Repair Trap routine to accommodate the problem that may occur when three or more objects overlap in the same area of a page, as shown in FIGURE 13A-13C. The explanation of FIGURES 13A-13C will be reexamined, with the supposition that Repair Trap is invoked.

With reference to block 182 of FIGURE 8, again the background object under consideration is Object X. Since Object Z overlaps Object X, it may need to be trapped against Object X. The clipping path is set at block 184 and Repair Trap is called at block 186. Since Object Z has not been trapped before (block 200, FIGURE 9), control returns to block 188 of FIGURE 8. Assuming, as above, that Object Z is to be trapped, the trap color and placement are determined at block 190 and the trap 232 drawn, as shown in FIGURE 13B. Once the trap 232 is drawn in block 192, a test is made at block 194 to determine if any objects remain in the shape directory that have not been considered. Object Y has yet to be considered, and the routine loops to block 180 where Object Y is retrieved. Object Y is now the "background object" being compared to the current object, Object Z.

With reference to block 182, since Object Z overlaps Object Y, it may need to be trapped against Object Y. The clipping path is set at block 184. FIGURE 14A and B indicate this step by showing Objects X and Z as dashed lines, e.g., these areas are not considered by the RIP in the reaming steps. Repair Trap is again called at block 184. With reference to FIGURE 9, the current object, Object Z, has been previously trapped (trap 232), and the routine continues to block 202. At block 202, the edges at which Objects Z and Y overlap are stroked using the fill color of Object Y. This is indicated in FIGURE 14A, with the dashed area 238. As can be seen, this step has the positive effect of removing the trap 232 from the effected area of Object Y, designated by reference numeral 238a. However, the step has the negative effect of overwriting a portion, area 238b, of Object Z. Thus, at block 204, Object Z is filled with its own fill color, shown by area 240. As will be appreciated, filling Object Z with its own color will erase any portion of the trap 232 that might remain in area 240, i.e., that may have extended beyond the area 238b. Having completed block 204, the routine returns to block 188 of FIGURE 8.

At block 188, a test is made to determine if Object Z should be trapped against Object Y. Assuming, as above, that Object Z is to be trapped against Object Y, the trap color and placement are determined at block 190 and the trap 232 is drawn at block 192. The trap 234 is again created, as shown in FIGURE 14C. It is noted that as a result of the Repair Trap procedure, the trap 232 no longer includes the right hand corner of Object Z, which is also shown in FIGURE 14C. After drawing the trap 234 at block 192, a test is made at block 194 to determine if there are any shapes in the shape directory that have not been considered. At this point, there are no other objects in the shape directory to be considered, and the process is complete. Thus, control returns to the routine of FIGURE 7, which has also been completed.

As will be appreciated, the resultant traps in FIGURE 14C are superior to the solution shown in FIGURE 13C because the effects of earlier traps have been removed. It will also be appreciated that

other methods may be used to achieve this same result, and the invention is not to be limited to the particular routine set forth in FIGURE 9.

As will be appreciated from the foregoing, a trapping program in accordance with the teaching of the invention allows trapping capabilities to be provided to originating programs without the need to change the code in the originating programs. The trapping program thus runs on top of and completely transparent to the originating program.

While the preferred embodiment of the invention has been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention. For example, the instructions to the RIP to trap PDL files may be sent to the RIP independently, or be resident at the RIP, separate from any particular PDL file.

Claims:

EP 674277 A2

1. A method of electronically trapping a printed page including a plurality of objects expressed in a page description language, the page description language instructions being rendered by a raster image processor for output to an output device, the method comprising the step of providing instructions to the raster image processor to trap the objects in the page as the page description language instructions comprising the objects are interpreted by the raster image processor.

2. The method of Claim 1, wherein the printed page is in a publication in a desktop publishing program, the publication including a prolog and a script that specify the objects to be printed, the method further including the step of modifying the publication prolog to provide the instructions to trap to the raster image processor.

3. The method of Claim 2, wherein the script is sent unmodified to the raster image processor.

4. The method of Claim 1, wherein the page description language instructions comprising the objects are sent unmodified to the raster image processor.

5. A method of electronically trapping a printed page within a publication in a desktop publishing program, the publication including a prolog and script that specify a plurality of color objects when being rendered by a raster image processor, the method comprising the steps of:

(a) modifying the publication prolog to instruct the raster image processor to (i) create a directory of the color objects in the publication and (ii) trap the color objects in the publication using the directory; and

(b) sending the modified publication prolog and script to the raster image processor.

6. The method of Claim 5, wherein the areas are created as the publication is interpreted.

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